THE INDUSTRY'S RECOGNIZED AUTHORITY

# ROCK PRODUCTS

DECEMBER 1953

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD

**Instrumentation article on phosphate plant in this issue**

# "COMPLETELY PLEASED" WITH HIS ALL-CAT* QUARRY

This flagstone quarry at Amazonia, Mo., is entirely Caterpillar-powered. The 1½-yd. Link-Belt Speeder and 500-ft. Gardner-Denver compressor in the illustration are driven by Caterpillar D13000s. Also on the job are a track-type D8 Tractor and two rubber-tired DW10s. This Cat team produces 2250 tons in a nine-hour day, 24 days a month, for a naval ammunition depot.

George W. Kerford Quarry Co. is the owner. Al Larson, superintendent, explains his company's standardization this way: "I know Cat machines are good, and I'd never think of changing from a product I'm completely pleased with."

Many quarrymen find that it pays in cold cash to standardize on Caterpillar equipment because it stays on the job. Standardization pays in other ways, too: in increased operator familiarity and efficiency, and in a single, reliable source for parts and service. That source is your nearby Caterpillar Dealer, who has factory-trained mechanics and a full line of genuine Caterpillar parts.

All Caterpillar Engines deliver full power on money-saving No. 2 furnace oil. Whether idling or fully loaded, they don't foul up. Leading manufacturers can supply these tough, quality-built Diesels in their equipment. Or your Caterpillar Dealer can install them when you repower. 12 sizes of engines and electric sets are available up to 500 HP and 315 KW. Ask your dealer about the units that are best suited to your needs.

Caterpillar Tractor Co., Peoria, Illinois.

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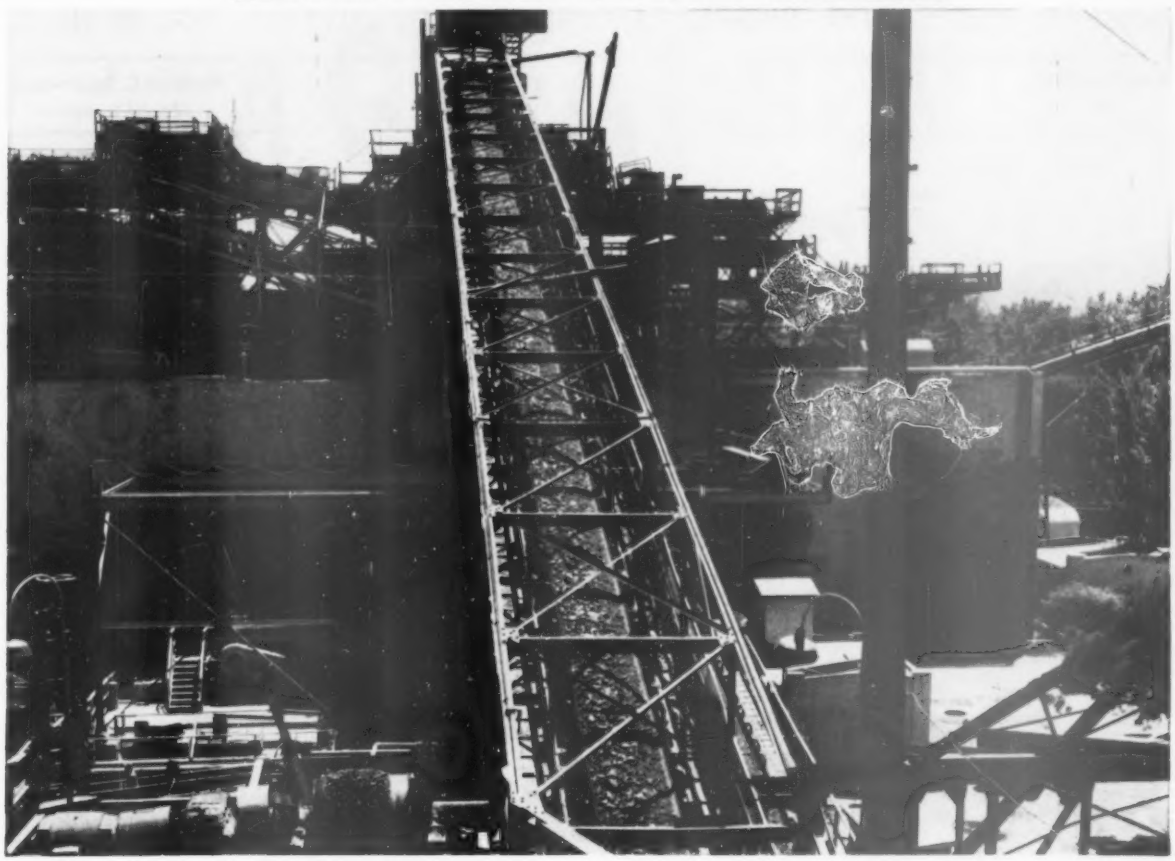
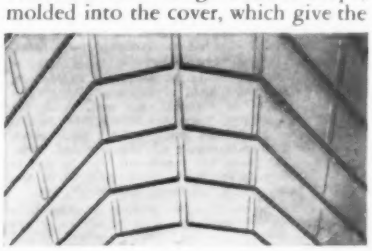
RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



# Wet, slippery gravel climbs uphill on steps of rubber

GETTING tons of gravel up that steep incline was causing plenty of trouble at this plant. A conveyor belt was used but the gravel is so wet it often slipped *down* faster than the moving belt could carry it *up*.

Then a B. F. Goodrich man told the company that BFG had developed a special belt, called Riffle Grip, to meet just such problems. Its cover has a series of extra-tough rubber steps, molded into the cover, which give the belt its nonslip, gripping action. The patented Riffle Grip belt was tried at the gravel company, and as you see, it works perfectly.



Even at the high belt speed needed to move 1200 tons an hour, the rubber tread holds the gravel safely, surely. The water runs off to the sides. Yet just by changing the incline angle and adjusting the troughing idlers, this same BFG belt can haul such sloppy materials as wet mixed concrete and keep the water from draining away.

The B. F. Goodrich Riffle Grip belt is now at work in other gravel plants, on gold dredges, in concrete plants and other places where wet, sloppy materials must be carried up steep grades. It's making many mining and construction jobs cheaper, more efficient. To get further information on the unusual Riffle Grip belt, simply send the coupon below, or call in your nearest BFG distributor.

*The B. F. Goodrich Company*
*Dept. M-115, Akron 18, Ohio*

Without cost or obligation, please
- ☐ send me more information on the Riffle Grip belt.
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Company_____

Address_____

**B.F.Goodrich**
**INDUSTRIAL PRODUCTS DIVISION**

# ROCK PRODUCTS

DECEMBER, 1953 THE INDUSTRY'S RECOGNIZED AUTHORITY VOL. 56, No. 12



**Bror Nordberg**
*Editor*

**Nathan C. Rockwood**
*Editorial Consultant*


## This Month


**We Hear** 67

**Editorial—Source of Ideas on Building Good Community Relations** 73

**Rocky's Notes—The Philosophy of A. F. of L.'s President** 75

**Labor Relations Trends** 77

**People in the News** 79

**Industry News** 83

**Hints and Helps** 86

**New Machinery** 88

**Producing Pozzolans and Lightweight Aggregate** 92
The Airox Co., Los Angeles, Calif., produces a very active pozzolan for concrete admix purposes and a lightweight colored aggregate *Walter B. Lenhart*

**Instrument Control in Phosphate Processing** 94
International Minerals and Chemical Corp., Bartow, Fla., uses many automatic control instruments in its beneficiation of phosphate at Noralyn *Dave Anderson*

**Of What Value are Coarse Particles in Agstone?** 97
*Ralph Simpson*

**Ideal Cement Co.'s Research Center** 98
Costing approximately $500,000, the new research center of Ideal Cement Co., will serve 11 plants with research studies applied to production techniques and cement uses *G. C. Wilsnack*

**Making A Stone Plant Dust-Free** 102
Eastern Rock Products Co., has installed wet-type system of dust control at the Prospect, N.Y. plant. Plant also pioneered in the use of electrically heated screens *Walter B. Lenhart*

**Facts for the Cement Industry on the Flow of Slurries** 104
*Dr. John R. Van Wazer*

**Unusual Sand Recovery System in "Packaged" Plant** 108
Windsor Building Supplies Co., Newburgh, N.Y., makes two sizes of gravel and two sizes of sand. Sand scalper-sizer is a four compartment settling device *Walter B. Lenhart*

**Theory and Practice of Lime Manufacture** 111
Part VII. Temperature control of high capacity kilns *Victor J. Azbe*

**Industrial Sand Producers Discuss Problems** 115

**Non-Pressure Hydrator Produces High Quality Lime Hydrate** 118
Lee Lime Co., Lee, Mass., continues its modernization program with the installation of a new type lime hydrating system

**Inserted Construction In Rotary Kilns** *B. M. Pearson* 121

**Portables Supplement Stationary Plant** 122
The General Crushed Stone Co., Easton, Penn., is operating portable crushing and screening plants at Glen Mills, Penn., and Jamesville, N.Y.

**Calculation of Raw Mixes in the Manufacture of Cement** 126
*Zvonimir Pucar*

**Pozzolanic Cements from Blast Furnace Slag** 130
*R. C. Lied, H. H. Handwerk, T. N. McVay*

**CONCRETE PRODUCTS—**

**Applying Mass Production to Prestressed Structural Concrete** *A. R. MacPherson* 173

**Central vs. Transit Mix** *Jas. A. Nicholson* 176

**Precast Concrete Slabs for Industrial Floors** 182
*P. F. van der Meulen Bosma*

**A.C.I. Regional Meeting** 184

**Small Ready-Mix Concrete Plants** *Horace K. Church* 186



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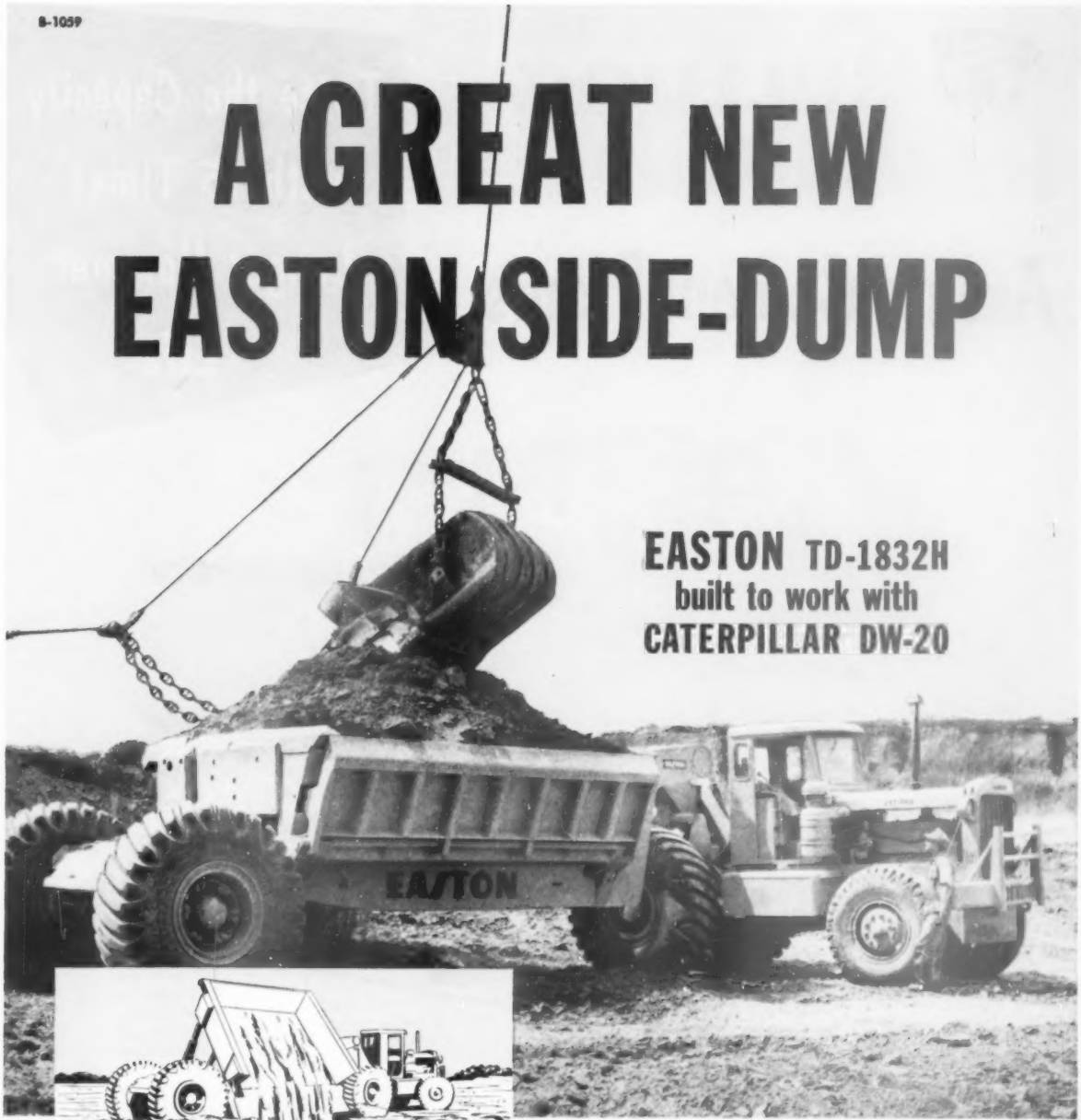

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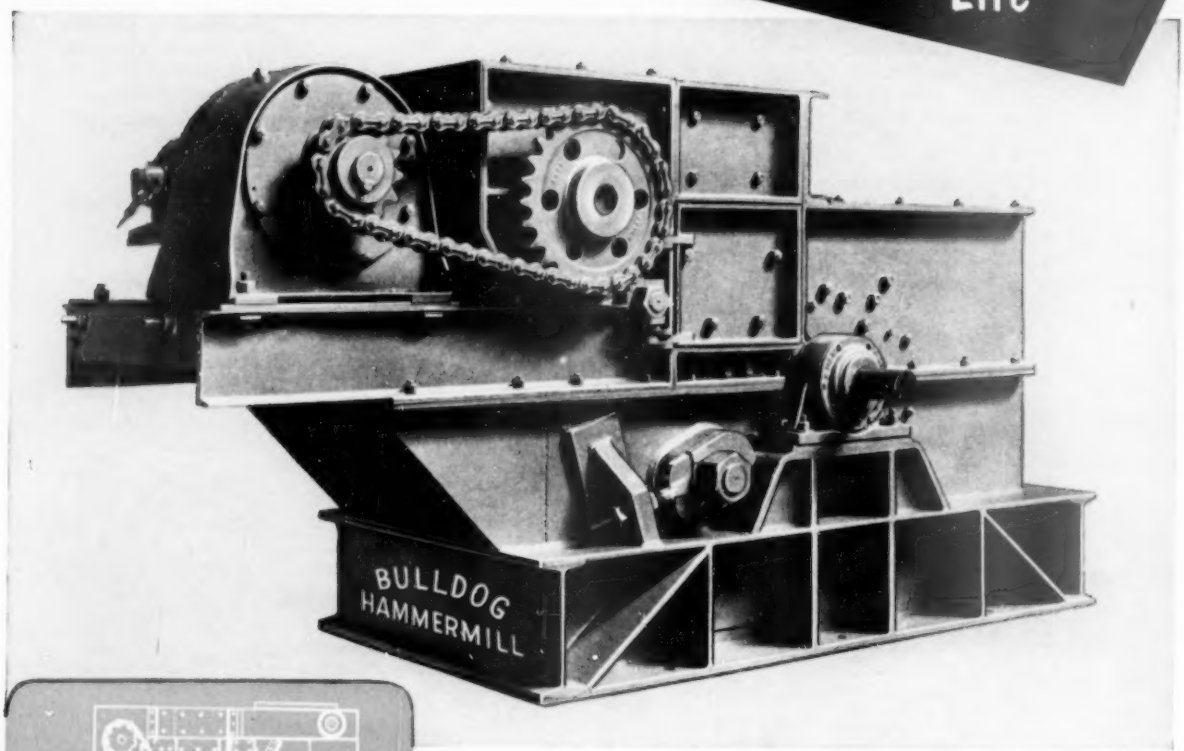


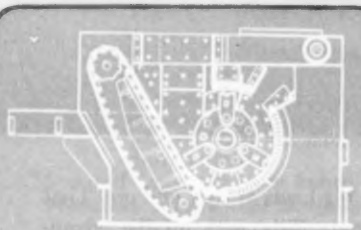

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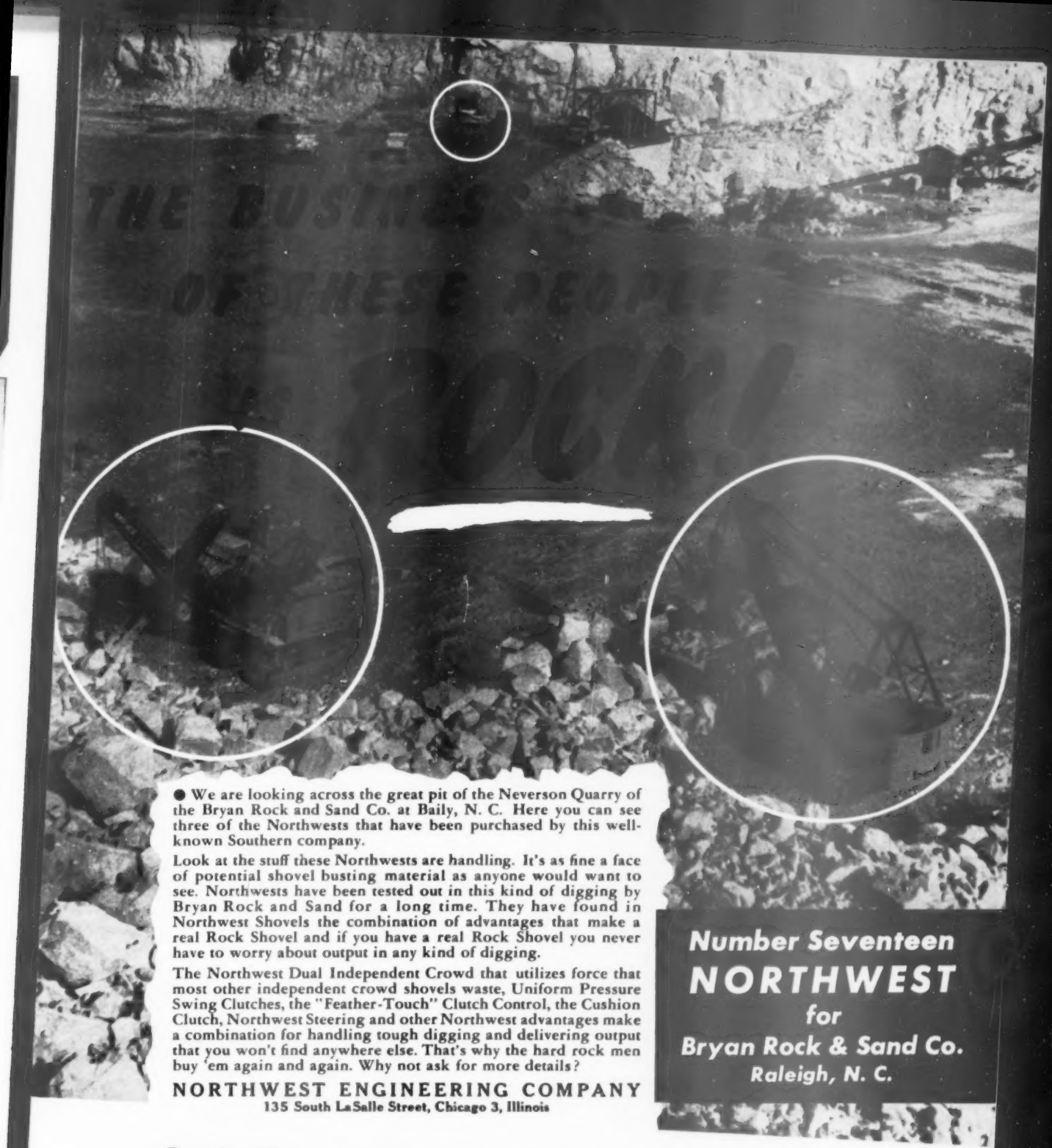

● We are looking across the great pit of the Neverson Quarry of the Bryan Rock and Sand Co. at Baily, N. C. Here you can see three of the Northwests that have been purchased by this well-known Southern company.

Look at the stuff these Northwests are handling. It's as fine a face of potential shovel busting material as anyone would want to see. Northwests have been tested out in this kind of digging by Bryan Rock and Sand for a long time. They have found in Northwest Shovels the combination of advantages that make a real Rock Shovel and if you have a real Rock Shovel you never have to worry about output in any kind of digging.

The Northwest Dual Independent Crowd that utilizes force that most other independent crowd shovels waste, Uniform Pressure Swing Clutches, the "Feather-Touch" Clutch Control, the Cushion Clutch, Northwest Steering and other Northwest advantages make a combination for handling tough digging and delivering output that you won't find anywhere else. That's why the hard rock men buy 'em again and again. Why not ask for more details?

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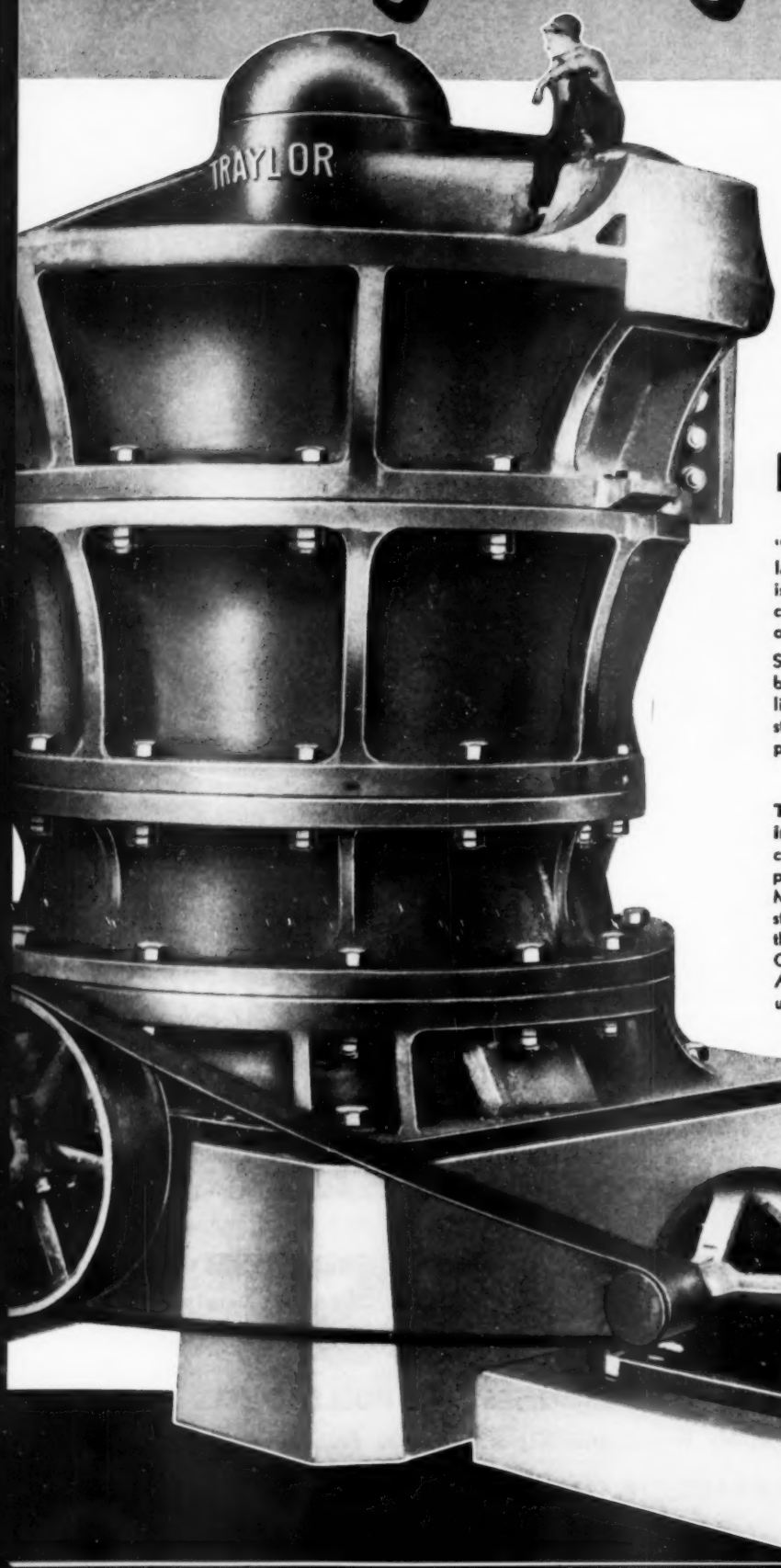
# BIG Gyratory Crushers




## THE 6th 60" GYRATORY BUILT BY TRAYLOR

"Traylored" to produce 30,000 tons per day, the latest of Traylor's super-size 60" Gyratory Crushers is on its way to the famous copper mine at Chuquicamata, Chile. This crusher is equipped with Traylor's original curved concaves and bell head.

Some idea of the weight of this gigantic machine can be judged from the relatively small eyebolt used to lift the shaft. It weighs over half a ton. The cast steel frame of the crusher is over 5" thick at several points.

**Traylor built the first successful 60" Gyratory in 1919 . . . 34 years ago.** It proved that a gigantic crusher with high hourly capacity could effect amazing production economies. This first 60" was sold to a Michigan limestone producer. Because of its outstanding efficiency, this same customer purchased their second 60" Traylor Gyratory four years later. Of these 60" crushers, three are in Michigan, one in Arizona, one in England and one in Chile. Capacities up to 3500 tons per hour.

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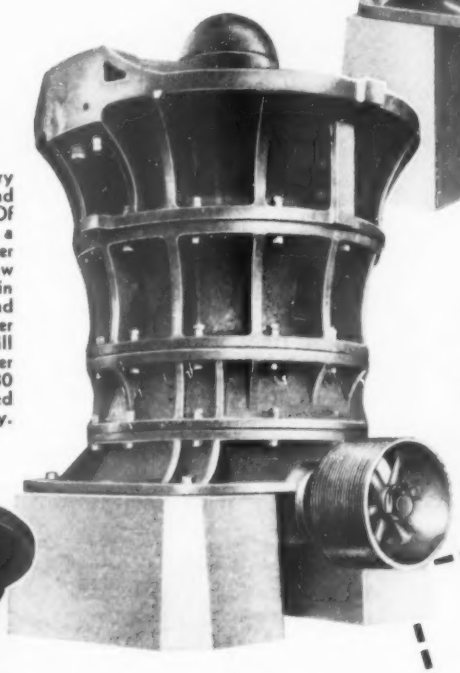
**Result:** Traylor has acquired special skills and facilities for building these big machines.

With 38 of these huge Gyratory Crushers in the field, Traylor design and construction have been proved under a wide range of operating conditions. To match this accumulated "know-how," Traylor has expanded facilities to build these big crushers with precision and efficiency. Consequently, the producer who needs 645 to 3500 tons hourly production will find the Traylor TC a crusher of unusual operating economy and dependability. Write concerning your requirements. Let us show why it pays in the long run to buy a Gyratory "Traylored" to your individual needs.

EIGHT 54" Traylor Gyratory Crushers are in the field; four in Canada, one in England, one in Mexico, one in Michigan and one in Nevada. These crushers are used to help produce cement, nickel, copper and iron. The Traylor 54" Gyratory has hourly capacities from 1400 to 2240 tons.



FOUR 48" Traylor Gyratory Crushers have been built and TWO are in the works. Of those in the field, one is in a Pennsylvania ore mine, another is crushing trap rock in New Jersey, still another is in Minnesota on iron ore and the fourth in Nevada on copper ore. The two in the works will be crushing iron ore and copper ore. Capacities up to 1980 tons per hour are obtained with the 48" Traylor Gyratory.

EIGHTEEN 42" Traylor Gyratory Crushers are in a wide range of service. One is in Chile, two in Canada and the rest dispersed over 14 different states. The 42" Traylor Gyratory provides capacities up to 1290 tons per hour.

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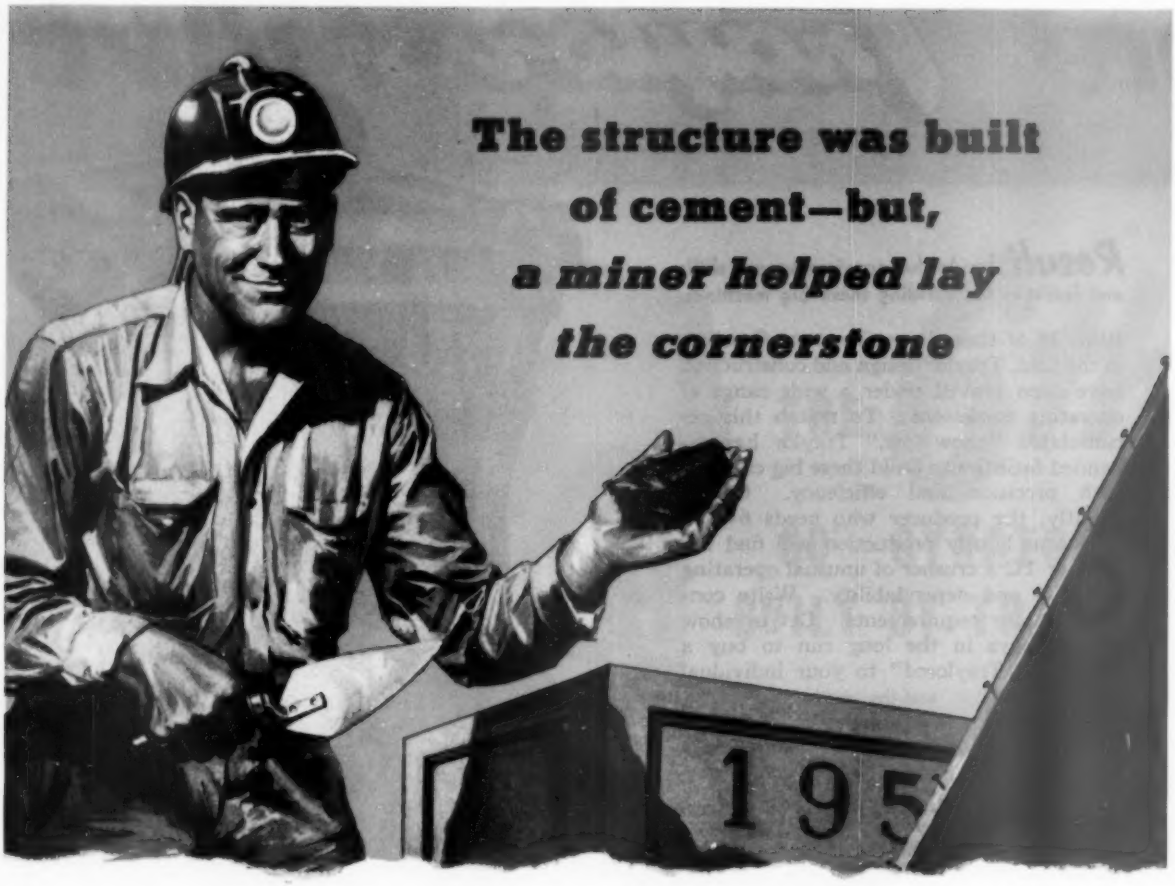
**9 Traylor has built 38 of the world's biggest crushers**

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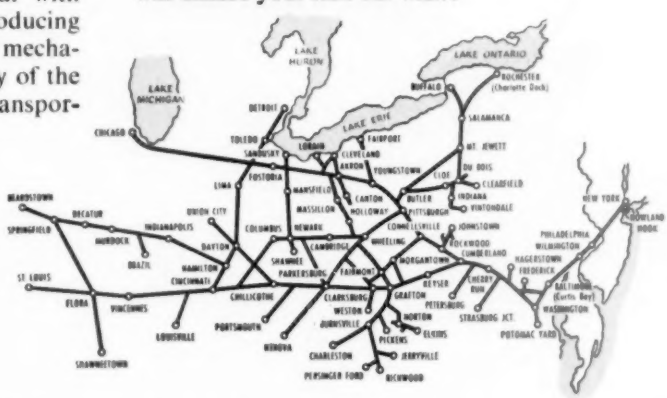


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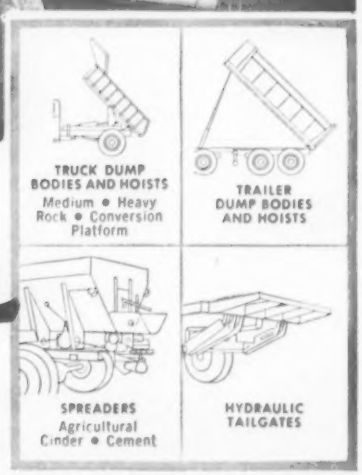
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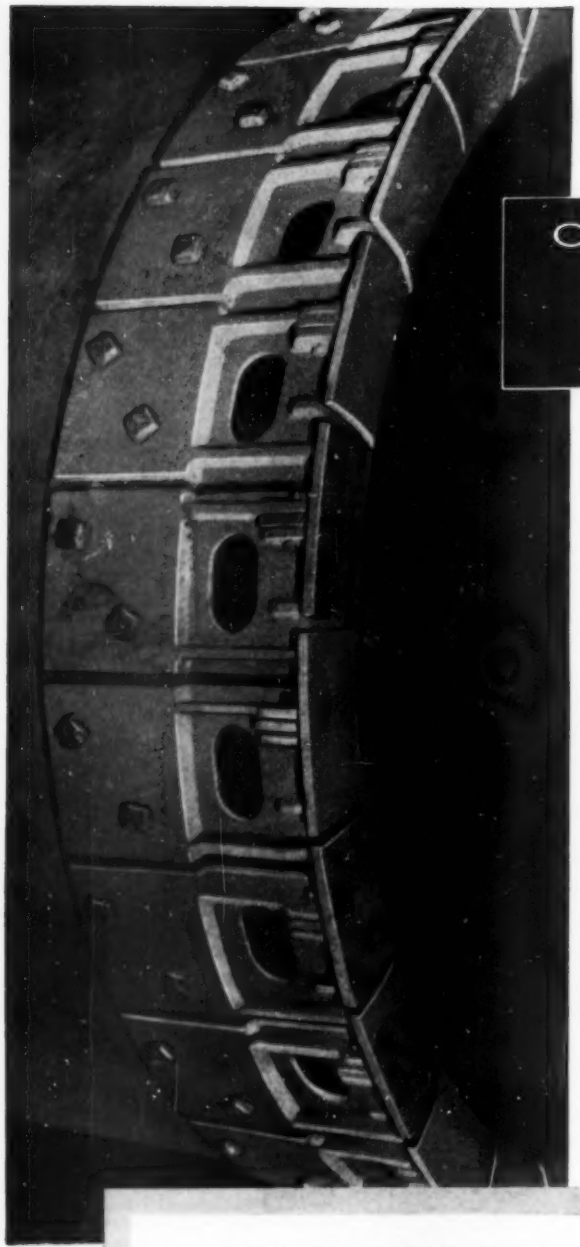

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*Reg. U. S. Pat. Off.

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"I bought this machine sight unseen on Caterpillar reputation, and it does even better than I expected," says L. A. Scharringhausen of his new Caterpillar No. 6 Shovel. This versatile unit, shown working in a gravel bed near Palatine, Ill., stockpiles and loads gravel, and strips about six feet of clay overburden. Average load is three tons of gravel—ample proof that its two-yard bucket is conservatively rated.

Even with a full bucket load, the tractor will not "dance." It is designed as a unit, with the weight of the bucket distributed so that the full track length stays on the ground. "It balances much better than I ever expected," Mr. Scharringhausen says.

The operator sits high and well forward and has excellent visibility ahead and to all sides. With an honest 66 HP at the drawbar, the Cat* No. 6 Shovel has plenty of power to handle full two-yard loads. A 96" heavy-duty quarry bucket is only one of many optional items that can add still further to the Caterpillar No. 6 Shovel's usefulness.

Ask your Caterpillar Dealer to arrange an on-the-job demonstration of this new and popular addition to the line of dependable yellow machines. Find out for yourself why so many quarrymen are adopting this fast-maneuvering, clean-dumping Caterpillar unit. And remember, you can always count on your nearby dealer for prompt service and genuine Caterpillar parts.

Caterpillar Tractor Co., Peoria, Ill.

**CATERPILLAR***

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**NAME THE DATE... YOUR DEALER WILL DEMONSTRATE**

# Sing A Song of Savings with The Tuffy Quartet

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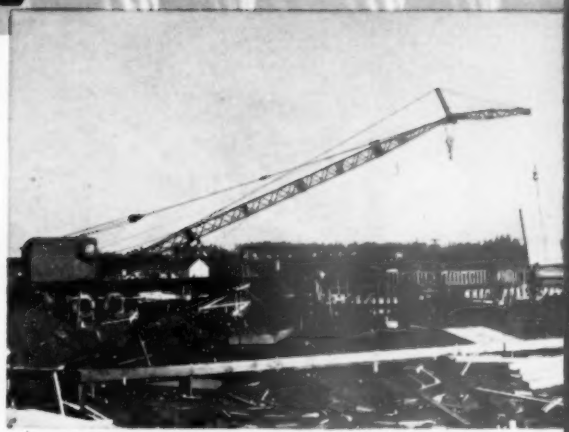
**"Couldn't Kink Them, Even When We Tried," Says owner of an Eastern construction company.**

Only Tuffy Slings give you the patented 9 part machine-braided wire fabric construction that resists knots and kinks . . . stands up longer than ordinary wire rope under rugged use. The 9 parts are interlaced in an exclusive way, forming a fabric that can be repeatedly bent around small radii and abrupt corners. You'll find Tuffy Slings are extra flexible, extra strong—and they can save you up to 40% on sling costs! Remember, they're proof tested to *twice* the safe working load.



No need to worry about knotting and kinking when you use Tuffy Slings.

## Tuffy DRAGLINE

**"Best Wire Rope Service . . . on 33 Draglines" Says Superintendent of a Florida rock producing company.**

Easy to handle, Tuffy Draglines are designed to take sharper bends, angle pulls and rapid line speed. Wires of finest steel provide extra flexibility without sacrificing other qualities . . . and you'll find Tuffy Draglines have a super tough construction for maximum resistance to drum crushing abuse, crawling on guide roll flanges, etc. Union-formed (pre-formed) Tuffy construction stands up longer than ordinary wire rope under line pull, multiplied shock of load on slack line and the stress of all types of material! Tuffy is easy to order, too! All you need is—length, diameter and the name . . . "Tuffy!"

On jobs like the building of Dams, Tuffy Draglines give dependable performance on any type of equipment.

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**union**

*Wire Rope*

**corporation**

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**Tuffy SLINGS**

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**Tuffy SCRAPER ROPE**

**Tuffy DOZER ROPE**

Grading jobs, like this one near Cadillac, Michigan, call for Tuffy Scraper Rope.

Moving overburden at this West Virginia strip mine is the kind of day-in, day-out job where Tuffy Dozer Rope steadily proves its extra worth.

## Tuffy SCRAPER ROPE

**"Outlast Other Rope Almost 2 to 1" Says a Middlewestern Contractor**

Wheel scrapers need a wire rope that will stand up under more varied strains and stresses than hoist or other standard ropes . . . and Tuffy Scraper Rope fills the bill! Each strand is pre-shaped, which relieves it of internal stresses. This leaves the full strength of every strand free to carry its share of the rope load. Tuffy Scraper Rope is flexible enough to stand up under sharp bending, hug sheave grooves, and wind snugly and smoothly on the drums. Tuffy is so designed to resist drum crushing caused by rope cross-overs. What's more, no complicated specifications are necessary when you order Tuffy! Just ask for Tuffy Scraper Rope and specify diameter and length.

## Tuffy DOZER ROPE

**"A Reel of Tuffy Dozer Can Save Up To 300%."**

Wire rope gets extra-rough service on a dozer, and Tuffy Dozer Rope was specially created for the job. But Tuffy engineers went even further . . . they designed a reel to mount on the dozer and help you stop rope wastage. When rope is cut or crushed on the drum, you just feed through enough from the reel to replace the damaged part. You save the 40′ to 50′ that would normally be thrown away! Users report an increase in service of up to 300%! And you'll find replacement takes less than *half* the time usually needed! Tuffy Dozer is a special ½" wire rope, available in 150′ reels. Use Tuffy on your Dozer —and *save!*

END FOR THESE FREE FOLDERS

**union Wire Rope corporation**

*Specialists* *In Wire Rope and Braided Wire Fabric*

**2156 Manchester Ave., Kansas City 3, Mo.**

**Please send me the illustrated folders I have checked below:**

- ☐ Tuffy Dragline
- ☐ Tuffy Scraper Rope
- ☐ Tuffy Dozer Rope
- ☐ Tuffy Slings

**Firm Name**_____

**By**_____ **Title**_____

**Address**_____ **City**_____ **State**_____

On road maintenance, Tournatractor eliminates need for pull-grader. Because it gets to this clean-up job oftener than the crawler used to, tire and spring breakage on haulers has been reduced.

Electric-control down-pressure helps Tournatractor smooth out rocky pit floor for truck turn-around. Unit has no troublesome hydraulics or complicated mechanical linkages.

# Tires outlast tracks, 4 to 1, for Miami Crushed

## Some of the jobs Tournatractor does:

1. *Piles about 1000 cubic yards of truck-delivered sand on stockpile per 9-hour shift*
2. *Spots railroad cars*
3. *Loads and unloads machinery from trailers*
4. *Feeds sand into hopper at concrete plant*
5. *Maintains haul road for rock wagons*
6. *Cleans up around 4-yd. dragline*
7. *Cleans up shovel and hopper loading areas*
8. *Helps maintain rock stockpiles*
9. *Moves railroad cars at cement plant*

This Miami concern is one of the largest screening and stone crushing operations in Florida. It ships 75,000 to 100,000 tons of sand and crushed oolite (coral) monthly to road, airport, and levee projects around the state.

Until a year ago, sand stockpiling and scattered dozing jobs were handled by a 102 hp crawler-tractor. Not only was the crawler's range of operations limited, but in this abrasive material, its tracks and rollers had to be replaced 3 times a year, or about every 900 hours.

### Works up to 20 hours daily

To lower maintenance costs, Miami Crushed Stone replaced the crawler with a rubber-tired 186 hp Tournatractor. After operating 9 to 20 hours a day for 9 months (a total of 3800 hours) in the hard, abrasive sand and rock, Tournatractor still is running on original tires. Although about ready for recapping, these tires have already outlasted the crawler tracks, on an hourly basis, by more than 4 to 1.

### Cuts idle time in half

Tournatractor is on call two shifts daily, 6 days per week. On dozing work, operator estimates it regularly makes two passes to crawler's one. Its "go-anywhere" mobility and 19 mph speeds enable it to handle more jobs (some of them a mile apart) and do them faster than was possible with the crawler. A

## Here's what men on the job say about Tournatractor

**Supt. A. G. Clapp:** "Tournatractor's doing a very satisfactory job. The things I like best are its rubber tires and its flexibility for running back and forth to the pit and pushing sand. We bought it to get tracks and rollers out of the sand. That it's done."

**Asst. Supt. C. S. Monroe:** "Tournatractor's main advantages are its speed, its maneuverability on the job, and its ability to drive over paved roads. Operator can do

LET

HIGH-SPEED, RUBBER-TIRED EXCAVATING • HAULING • LIFTING

Tournatractor pulls cars up to loading chute. Operator Woodward says unit can move up to 20 loaded or 40 to 45 empty cars. Rubber tires do not damage tracks or ties.

# Stone Company

measure of its travel and work capacity is indicated by its 3800 working hours in 9 months compared to the crawler's 5200 in 2 years. Part of the crawler's lower working total is accounted for by the downtime for track repair and maintenance. In addition, crawler frequently was idle because it could not handle widely-scattered jobs economically or travel across surfaced roads or railroad tracks without bothersome planking.

What Tournatractor is doing for Miami Crushed Stone Co. in increased output and lower costs, it can also do for you. Before you buy another set of tracks, it will pay you to investigate this rubber-tired tractor. Your LeTourneau-Westinghouse Distributor can arrange a demonstration on your job.

Low-pressure tires provide good traction in soft, shifting material as Tournatractor stockpiles fine screenings. Unit has no track pads, idlers or unprotected bearings to grind away.

a better job all day long because ease of operation reduces fatigue. We also don't get the breakage on rock stockpiles with tires that you would with a crawler."

**Master Mechanic B. H. "Goose" Pendarvis:** "Doing all kinds of rough work, Tournatractor tires have gone 3800 hours without trouble or recapping. This sand work just eats up crawler tracks. They used to last about 3 or 4 months (650 to 900 hours). Another advantage of Tournatractor is that it takes only a jiffy to get ½ mile from one pit to another. Don't have to board roads like with a crawler. Can go over and do work and be back before a crawler would get to the crossroad."

**Operator Luther Woodward:** "I like Tournatractor fine. It's fast, good for doing lots of odd-jobs fast. Pushing 150 ft. in sand, you make two passes to crawler's one. It has good seats, and you're not jerking levers all the time."

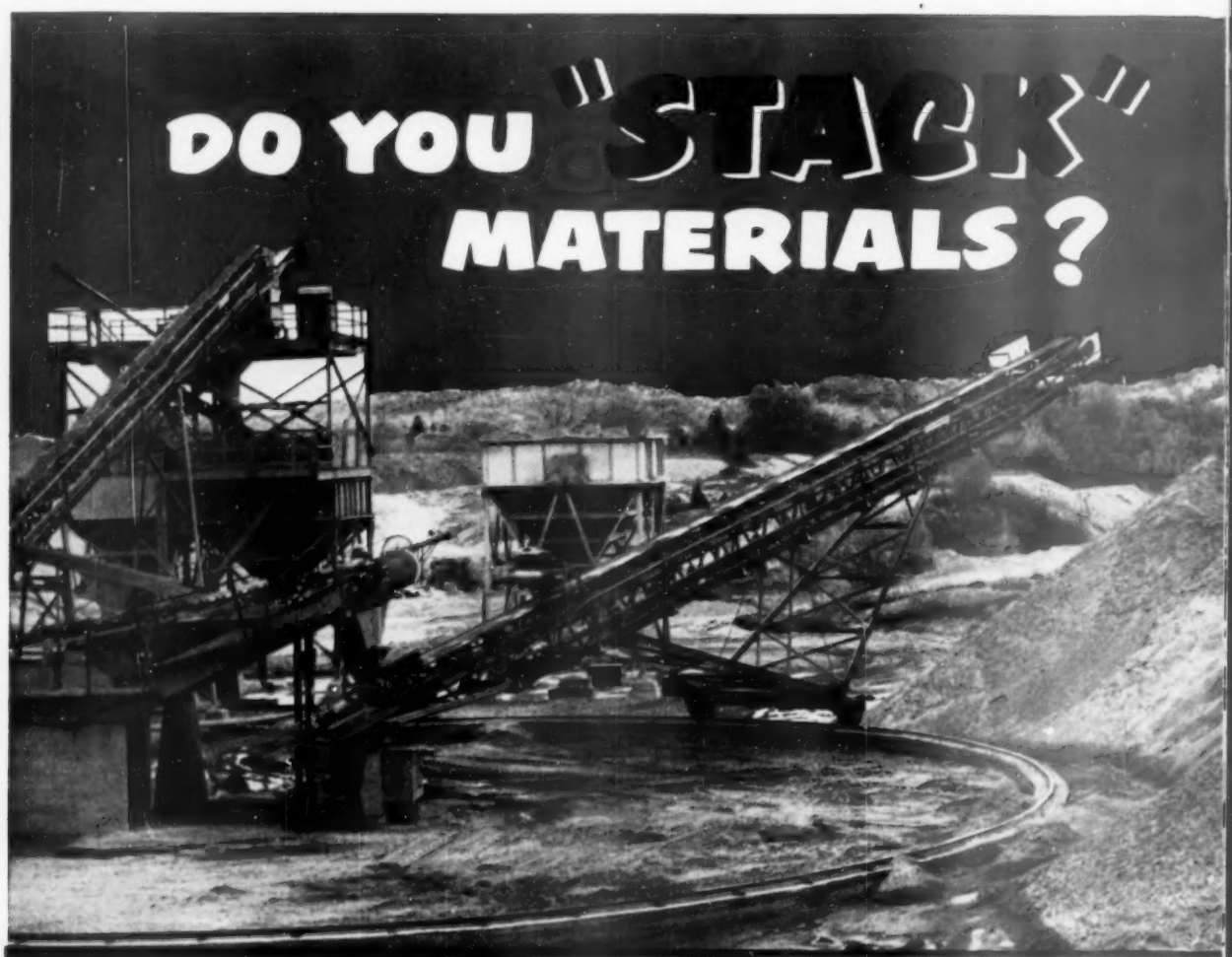
Tournatractor—Trademark T-402-S

EQUIPMENT

## LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

# DO YOU "STACK" MATERIALS?



## DO IT BEST WITH BARBER-GREENE CONVEYORS!

### TYPICAL STACKER APPLICATIONS

- For the stock-piling of bulk materials such as sand, gravel and aggregates
- In mining operations where ore or coal is stock-piled to suit market or seasonal conditions
- In material yards, ready-mix plants or coal yards where classification into separate bins or large stock piles is advantageous for meeting peak demands
- For disposal of waste material
- Wherever structural supports in stock pile handicap operation of reclaiming machines

*write for information!*

282-A

see your **B-G distributor** ...or write

# "STACKER"

## WHAT TYPE DO YOU NEED IN YOUR BUSINESS?

## BARBER-GREENE SUPPLIES THEM ALL

### RADIAL STACKERS

Radial stackers have a pivoted receiving end about which the conveyor revolves to load direct to truck, to load in a kidney-shaped pile or to classify into different bins. May be mounted on swivel wheels or on swivel trucks operating on curved rails. Rotation is by hand or power. Furnished in all belt widths to lengths as great as 120 feet on curved rail tracks.

### TRAVELING STACKERS

As the name suggests, traveling stackers may be moved from one position to another to make stock piles in various open rail locations. May be mounted on wheels, crawlers or trucks. One popular type is mounted on four wheel trucks to move lengthwise to build stock piles in long, straight lines. Traveling Stackers are furnished in all belt widths to lengths of 120 feet.

### FIXED STACKERS

The most widely used stacker system. Fixed stackers are designed for applications where the material is to be stacked and discharged from a cantilever conveyor at the head end onto a storage pile or a disposal pile. Here, as with radial and traveling stackers, the clearance of support structures in the space under a stock pile does not interfere with the operation of reclaiming machines. All belt widths and lengths.

# Barber-Greene

BG

*Aurora, Illinois, U. S. A.*

# "this NEW Cedarapids SUPER is the star performer

**HERE'S the Cedarapids Super Tandem Gravel Plant *newly engineered* for star performance on jobs where gradation of a big volume of material is the most important of the plant operations. The Super Tandem is now built with a 48″ x 12′ Horizontal Vibrating Screen to give you the really high screening capacity that is a big advantage in any pit and is especially profitable where there's a high percentage of fines or contaminated material. Other Super Tandem features, like the 1036 jaw crusher, 2416 roll crusher and 30″ wide conveyors, are engineered to handle this extra capacity with no increase in operating or maintenance costs. See your Cedarapids distributor for complete details.**

THE IOWA LINE *of Material Handling Equipment Includes:* ROCK AND GRAVEL CRUSHERS • BELT CONVEYORS • STEEL BINS • VIBRATOR AND REVOLVING SCREENS • UNITIZED ROCK AND GRAVEL PLANTS • FEEDERS • PORTABLE POWER CONVEYORS • PORTABLE AND STATIONARY STONE, GRAVEL AND SAND PLANTS • REDUCTION CRUSHERS • BATCH TYPE CONTINUOUS MIX TYPE BITUMINOUS MIXING PLANTS • DRIERS • DUST COLLECTORS • HAMMERMILLS • WASHING PLANTS • MOTORIZED HEAD PULLEYS • VIBRATING SOIL COMPACTION UNITS • DOUBLE IMPELLER IMPACT BREAKERS

# TANDEM

## for our jobs"

*Say the Place Brothers of Scranton, Iowa*

**"we're getting 100% more screening . . . 25% more conveyor than the Junior Tandem we operated . . . 228 to 310 tons per hour . . . steady operation day in and day out . . . very low maintenance . . . THAT'S PROFITABLE PERFORMANCE!"**

Burl Place (left) and LeRoy Place are producing ¾" minus crushed gravel to the tune of a 228-ton per hour average . . . with peak production hitting 3560 tons in an 11½-hour day! Average per cent of crush was 20% with portions of the material wet, with some clay. Burl Place says, "This new Super Tandem is very trouble-free and dependable. We can plan on operating at full 11½-hour day every day, weather permitting, and maintaining the high average production that keeps us ahead of our competition."

### "OUTSCREENS ANY OTHER SCREEN I'VE EVER SEEN," says LeRoy Place

"That big 48" x 12' horizontal screen is a humdinger for the kind of work we do . . . processing semi-wet material with a high percent of fines. For capacity alone, it outscreens any screen I've seen operate, and by reducing the circulating load, we have less wear on the crushers. Add the screen's trouble-free operation and the result is the extremely low maintenance, high capacity machine we need to operate a successful business in tough competition. Our maintenance cost runs less than ¾ of a cent per yard."

### HIGH FLEXIBILITY

The Super Tandem is designed to handle a wide range of crushing and screening conditions. Optional equipment which increases flexibility includes swivel feed conveyor, spray bar attachments and sand ejector screw. Cedarapids Primary Crushing Unit used ahead of the Super Tandem converts it into a high capacity rock plant. "Packaged" Super Tandem separate units are available for stationary operation.

### 30" WIDE CONVEYORS

As part of the new-design efficiency of the Super Tandem, the width of the delivery conveyors, plant conveyor and under crusher conveyor has been increased to 30" to handle the greater production of the plant.

The newly engineered Super Tandem is designed specifically to meet conditions where extra-high screening capacities are necessary . . . but *remember* . . .

### THERE'S A CEDARAPIDS PLANT TO HANDLE EVERY JOB!

The Master Tandem or Unitized Plant for the biggest jobs, the Commander Plant for high output of fine-crushed products, the Rock-It for producing roadstone and aglime, the Junior Tandem and Pitmaster for smaller jobs, the Cedarapids Single Pass Plant for low-cost road maintenance . . . a size and type to fit every job and every pocketbook.

FOR BITUMINOUS MIXING, the big Cedarapids Model E is ready for profitable big-job production, or the Master Plant, Model FA or Model PM Commercial Size Plant are available to meet any quantity, any specification requirement.

# IOWA MANUFACTURING COMPANY

## Cedar Rapids, Iowa, U.S.A.

IOWA MANUFACTURING COMPANY
Cedar Rapids, Iowa, U. S. A.

Gentlemen: Please send literature and information about equipment checked.

- ☐ Super Tandem Plants
- ☐ Gravel Plants
- ☐ Rock Plants
- ☐ Special Plants
- ☐ Horizontal Vibrating Screens
- ☐ Crushers
- ☐ Conveyors
- ☐ Washing Plants
- ☐ Bituminous Mixing Plants

Name_____

Company_____

Address_____

City_____ Zone____ State_____

# A UNIVERSAL production report to crushing plant operators

| | |
|---|---|
| **Plant Site** | Herington, Kansas |
| **Operators** | Anderson-Oxandale |
| **Requirements** | High tonnage of aggregate to meet state's exacting specification. Frequent moves and changes in product specification required. |
| **Equipment** | Universal 3240 Impact Master. Universal portable screening and blending unit. |
| **Type of rock** | Dolomite limestone. |
| **Production** | Currently they are meeting a difficult specification calling for a large percentage of minus ¼ inch. They are producing up to 150 yards per hour of which 100% passes a one inch screen, 90% passes a ¾ inch screen, 50-60% passes a ¼ inch screen. When desired Anderson-Oxandale can reduce the production of minus ¼ inch material by at least 50%. |

Anderson – Oxandale's portable 3240 Impact Master, crushing, screening, blending and loading plant operating near Herington, Kansas.

Anderson — Oxandale had to have a crushing plant that could be moved frequently with a minimum of down time, produce high tonnages of top-quality aggregate at each set-up, and meet exacting specifications. The Universal Impact Master (portable) with *Controlled Impact Action* combined with Universal's portable screening and blending unit was the answer.

The Impact Master, with *Controlled Impact Action* gives you four important advantages: (1) Greater control of the finished size of your material. (2) Cleaner, more cubical aggregate. (3) Lower operating cost — it requires less horsepower per ton. (4) Lower maintenance cost.

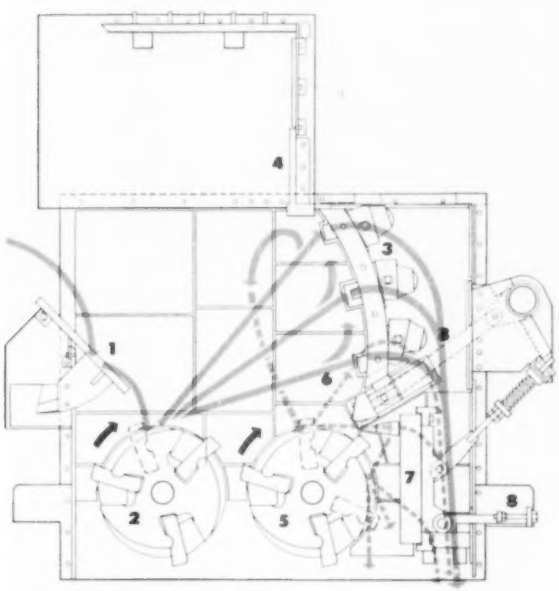
**What Is Controlled Impact Action:**

**Control point 1:** Controlled feed chutes the rock into the unobstructed path of the first rotor hammer circle for terrific impact, providing maximum unobstructed penetration. The angle of the plate can be quickly changed to handle rock of different size and density and meet varying quarry conditions. Incoming material penetrates the first rotor hammer circle at the correct angle for efficient breaking. **Control point 2:** you control the range of sizes by simply regulating the speed of the rotor hammers. **Control point 3:** you can easily adjust the stripper bar and lower screen grate to get the percentage of sizes you want.

With these three methods of control, you get what you want. It's no hit or miss proposition. "Controlled Impact Action" is more than a phrase with Universal. It's the key to the way all Universal Impact Masters produce more aggregate of higher quality to exact specification at lower cost.

*Portable 3240 Impact Master* with 3 speed transmission drive from diesel power mounted to the side. Slide mounted 36" x 16'-0" portable apron feeder. Eighteen inch closed circuit return conveyor from portable screening unit. 30" delivery conveyor to portable screening unit.

*Universal portable screening and blending unit.* All electric driven with 5' x 14' 3 deck inclined gyrating screen equipped with ball tray. Two 30" forward delivery conveyors and one 18" side delivery conveyor. Positive blending chutes with gates control different aggregate specifications. 18" return conveyor to Impact Master.




1. Adjustable feed plate
2. First rotor hammer
3. Deflector screen grate
4. Feed chute backplate
5. Second rotor hammer
6. Stripper bar
7. Bottom screen grate
8. Adjustments

**How the Universal Impact Master works:**

The diagram at left shows the flow of material. Adjustable feed (1) chutes the incoming rock into the first rotor hammer circle at proper angle. Rock is hit in motion, exploded into cubical shaped pieces by terrific impact of the rotor hammers, and at the same time hurled toward the deflector screen grate (3) where finished sizes are immediately discharged. Oversize particles are deflected upward, hit the feed chute back plate (4) and drop down into the path of the second rotor hammer circle (5) where they are reduced by impact and projected toward the bottom half of the deflector screen grate and the lower screen grate for immediate discharge. Both rotor hammers rotate toward the discharge opening. Material always flows rapidly in one direction. No grates, screens or bars obstruct the discharge opening. Large expansion chamber is also completely free of obstructions. All breaking is done by impact. There is no attrition, abrasive or grinding action. Thus wear is kept to a minimum.

More and more operators are turning to the Universal Impact Master, with "Controlled Impact Action." Its high production capacity, excellent performance, and simplicity of construction just naturally results in a more efficient, more profitable operation. Tonnages up to 750 tons per hour. Available in sizes: 3240, 3645, 4250 and 5260. Write for complete information today.

**UNIVERSAL ENGINEERING CORPORATION**

617 C Avenue N.W. Cedar Rapids, Iowa
A Subsidiary of Pettibone Mulliken Corporation,
4700 W. Division St. Chicago 51, Illinois

UNIVERSAL GAVE CEDAR RAPIDS ITS ORIGINAL FAME FOR QUALITY CRUSHERS IN CEDAR RAPIDS SINCE 1906

PMCP UNIVERSAL

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Whatever the application, whenever you are in doubt about what hardfacing alloy to use, you can reach for the new Amsco Catalog for the answer. It gives you complete analyses, metallurgical information, and other pertinent data about Amsco's line of automatic and manual hardfacing alloys. You can look up the right rod to use for hundreds of the more common applications. And for those extra tough jobs, you'll find the section on How to Select a Hardfacing Alloy indispensable. Although it's written by welding engineers, this new catalog is easy to understand and to apply its suggestions to your own operations.

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# Notice the CONCAVE SIDES of the Gates V-Belt-

(U.S. PATENT NO. 1813698)

## . . . that's why Gates V-Belts Last Longer!

*Look at this!*

**In *half a minute* you can prove for yourself the belt-saving advantage of the CONCAVE SIDES.**

Take any *straight-sided* V-Belt (Fig. 1) and bend it as it bends in going around its pulley. At the same time, grip its sides with your fingers and *feel* those sides *bulge out* as in Fig. 1-A.

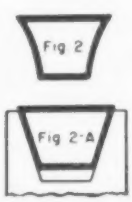
Clearly, those bulging sides will press *unevenly* against the V-pulley—and this causes extra wear at the points shown by the arrows (Fig 1-A).

Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

### Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)

As the belt bends, grip its sides—and you will feel the precisely engineered CONCAVE SIDES *fill out* to an *exact fit* in the sheave groove (Fig. 2-A).

These sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the full width of the Gates Vulco Rope—and this means *longer* belt life and *lower* belt costs for you!



**When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES— The Gates Vulco Rope.**

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

CS-537

**V-Belts — Hose Molded Rubber Goods for industry *World's Largest Maker of V-Belts***

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

# *CP CONTROLLED PRESSURE

Pressure is something you have to control, whether it's built up on the outside of a deep-sea diving suit, on the inside of a teakettle, or in the bloodstream of an angry or excited person.

Pressure is also a problem when you pump oil through an engine. Sometimes the oil is cold and sluggish. Other times it is hot and easy-flowing. You can't always wait for the oil to be at just the right temperature before you start the engine and need lubrication. You want the lubricant *now*, and you want it clean and dependable. That's the job of your filter.

Most filters don't function properly until the oil has been warmed up. The oil gets by-passed instead of cleaned. But that is not the case when you use Winslow "CP"* (Controlled Pressure) Elements. An exclusive and patented method of constructing Winslow "CP"* Elements makes sure that either hot or cold oil passes through the element instead of the by-pass, insuring positive Full Flow Filtration.

***WHY NOT GET FULL INFORMATION ABOUT WINSLOW "CP"* FILTRATION. SEND FOR THE NEW FREE BOOKLET THAT TELLS YOU ALL ABOUT IT!***

**WINSLOW FILTERS**

*TRADEMARK

**Winslow Engineering Company** • 4069 Hollis St., Oakland 8, Calif.

the inside story

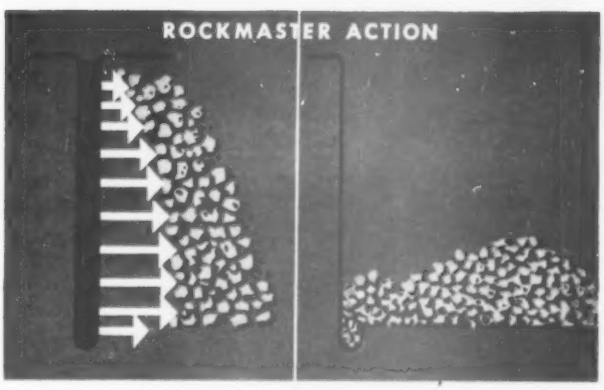
# Here's how ROCKMASTER® makes a workable muck pile

PHOTO above shows the pile that resulted from an alternate ROCKMASTER blast with detonation at the bottom of the holes. The crest of the pile is well out from the quarry face at just the right height for safe and easy digging. Compare this to the final pile in the photo at right. This is the result of a top detonated blast. The rock is piled high with the crest against the quarry face. Top rock, falling first, has covered the pile but bottom rock has not moved out. The top rock is where the bottom rock should be. The shovel will have to work on a high pile close to the face. This can be slow and dangerous especially in winter.

Only the ROCKMASTER system of milli-second delay shooting with detonation at the bottom of the holes can give you real control over throw. When the charge is fired at the bottom, the explosive force follows the line of least resistance . . . straight out to the free face. The toe moves out first, well ahead of the rock at the top. The result is a well shot pile, out from the quarry face for easy digging and loading.

Send for your copy of "Quarry Blasting the ROCKMASTER Way." It shows various ROCKMASTER quarry methods with machine gun photos.

*See the new Atlas movie, "The Inside Story," a technical discussion of Blast Hole Detonation. Make arrangements through your nearest Atlas Office.*




ATLAS

## ATLAS EXPLOSIVES

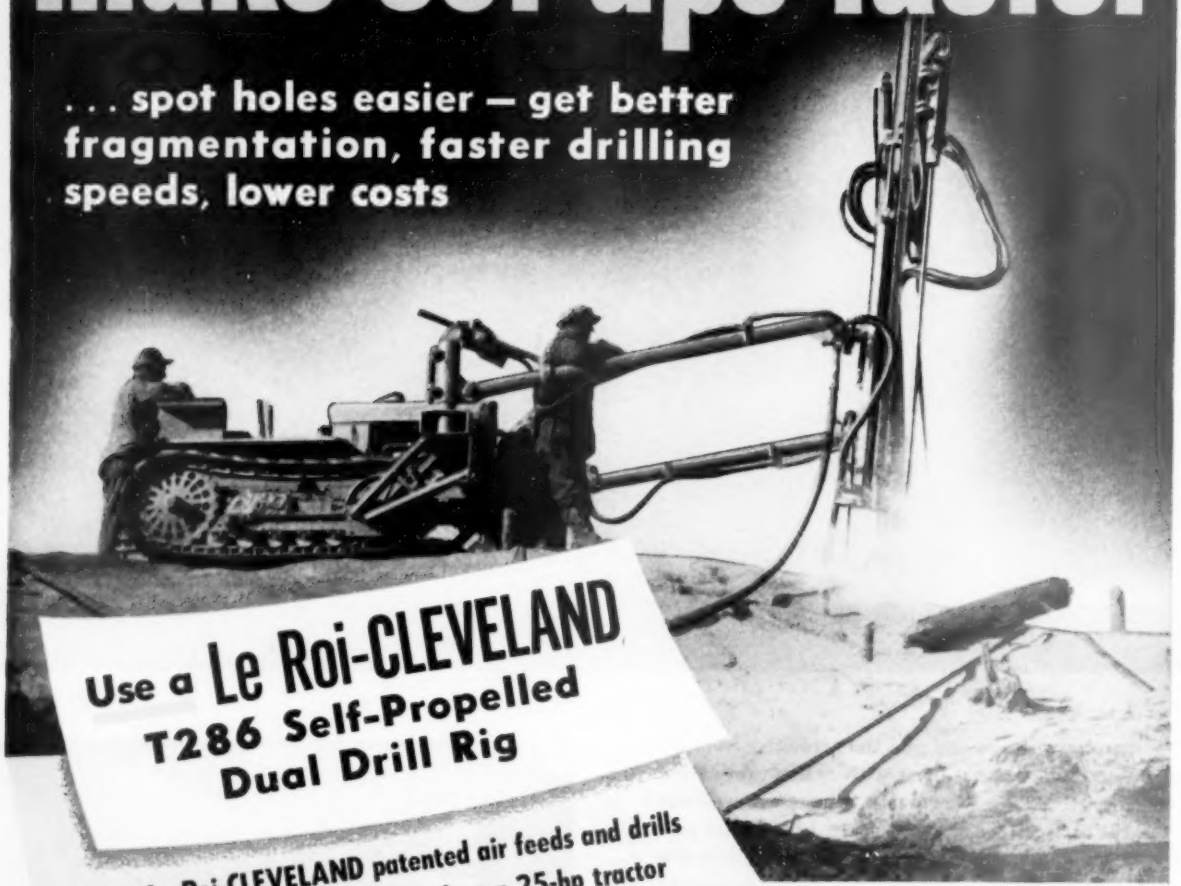
*"Everything for Blasting"*

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

*Offices in principal cities*

# make set-ups faster

. . . spot holes easier — get better fragmentation, faster drilling speeds, lower costs



## Use a Le Roi-CLEVELAND T286 Self-Propelled Dual Drill Rig

**It's 2 Le Roi-CLEVELAND patented air feeds and drills with air-motor booms mounted on a 25-hp tractor**

**3 speeds forward . . . 1 speed reverse**

ONE man *drives* the Le Roi-CLEVELAND T286 places you couldn't get to before with a wagon drill. And he tows the compressor right along. The T286 drills and cleans holes as deep as 30′ — in any direction — at any angle — with less air. All this means faster set-ups, better hole spacing, greater footage, better fragmentation, lower costs. Have your Le Roi distributor show you. Write for Bulletin RD-21.

One Le Roi Airmaster 600 cfm Compressor provides all the low-cost air you need to operate the T286 Dual Drill Rig, when it is equipped with Le Roi-CLEVELAND 4″-bore drifters. A smaller compressor is sufficient, when the T286 is equipped with the 45-lb. H10 or 80-lb. H25 (3⅛″-bore) sinker drills or 3½″-bore D25 drifter.

C-144

**LE ROI COMPANY**
*A Subsidiary of Westinghouse Air Brake Co.*
CLEVELAND ROCK DRILL DIVISION
12500 Berea Road, Cleveland 11, Ohio
*Plants:* Milwaukee, Cleveland and Greenwich, O.

# Peering at New Profits

The 'see it for yourself' approach is hard to beat when you want the real facts. This alert plant engineer sees new profits down his plant's stack.

New profits in terms of tons of valuable dust that can and should be returned to production rather than being wasted in the air.

Getting at those profits is our business! In one plant, for instance, Buell Engineers recovered over 200 tons of valuable dust in a single week. A clear example of the superior efficiency of Buell equipment. Just send in a sample of the dust, Buell Research can tell you how best to reclaim its value.

With these facts in hand, Buell has served dozens of America's Leading Companies. Why not send for the names of several in your own field?

Our informative brochure—The Collection and Recovery of Industrial Dusts—explains all three Buell systems of industrial dust recovery. For your complimentary copy, write Dept. 17-L, Buell Engineering Company, 70 Pine Street, New York 5, N. Y.

buell

MECHANICAL ELECTRICAL

*20 Years of Engineered Efficiency in*

**DUST RECOVERY SYSTEMS**

# MEASURE OUTPUT

## by "Koehring Work Capacity"

There are some very simple ways to measure output of excavators and cranes in advance. Take lifting capacities, for example. Obviously, the machine with the heaviest lift capacity will not only pick up larger crane loads, it also has more stability and power to increase shovel and hoe production — handles bigger dragline and clamshell buckets on a wider work range.

Be sure to check lift ratings, and other clear-cut measurements of "KOEHRING WORK CAPACITY", before you buy any excavator or crane. Your Koehring distributor has important figures to show you — ask for them.

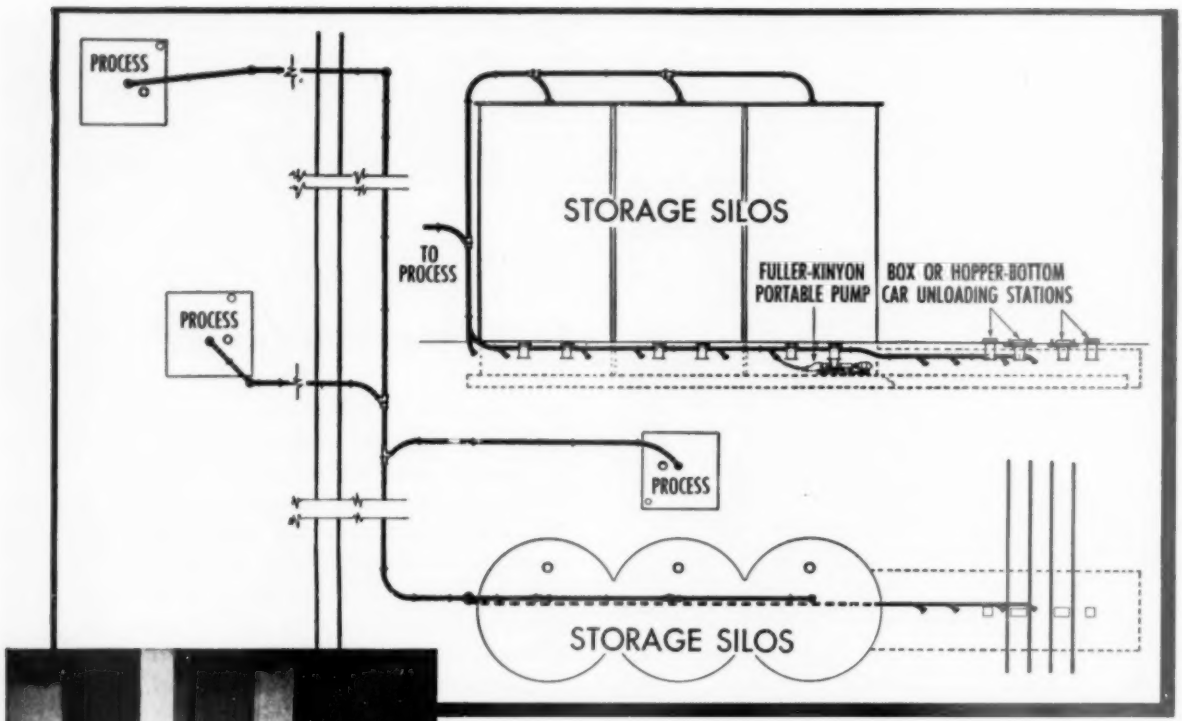
## KOEHRING Company

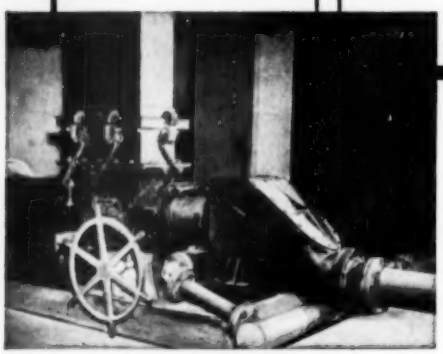
MILWAUKEE 16, WISCONSIN

*Subsidiaries:* PARSONS • KWIK-MIX • JOHNSON

K332

**lift capacities up to 79½ TONS . . . ½ to 2½ YARDS dipper capacities**



# *speed and economy assured with* Fuller-Kinyon

Deep in the heart of Texas, this Fuller-Kinyon Conveying System is at work handling bulk shipments of pulverized phosphate rock from cars to storage, for a prominent chemical company.

This same portable Fuller-Kinyon Pump, in addition to unloading from box or hopper-bottom cars, on adjacent tracks, and delivering to any one of three storage silos, can be moved on a track to positions underneath these silos. Connection is easily and quickly made to the silo to be emptied and material conveyed to any one of three widely separated process points in the plant. Advance designing makes this dual use of the Fuller-Kinyon Pump feasible.

Conveying is done at the rate of 50 tons an hour, with the longest conveying distance approximately 690 feet; together with branch lines making a total of about 1070 feet.

A Fuller Rotary Single-stage Compressor furnishes the necessary air to the Fuller-Kinyon Pump for conveying.

If you handle bulk shipments of dry, pulverized materials it will be worth your while to learn about Fuller air conveying systems now. Write today!

**Fuller**
CONVEYS BY AIR
CLEAN...SAFE...EFFICIENT

**FULLER COMPANY, Catasauqua, Penna.**

*Branch Offices*

Chicago • San Francisco • Los Angeles • Seattle • Birmingham

P-147
1844

**DRY MATERIAL CONVEYING SYSTEMS AND COOLERS • • • COMPRESSORS AND VACUUM PUMPS • • • FEEDERS AND ASSOCIATED EQUIPMENT**

P&H

# HARD HITTING STABILITY!

**No question about it— you've got it "on the hook" with a P&H!**

**Greater stability not only lets you handle heavy loads with less danger of tipping strains, but also enables you to use your power more freely — gives you the added capacity to get more done in a day's work. Rolled alloy steels, welded throughout, give you the structural strength to take it in stride.**

**But it doesn't stop there. True tractor-type crawlers give you the smoothest, surest-footed mobility you've ever known on a power crane or shovel. You can turn gradually, sharply, or right about-face — maneuver in and out of tight corners with perfect ease.**

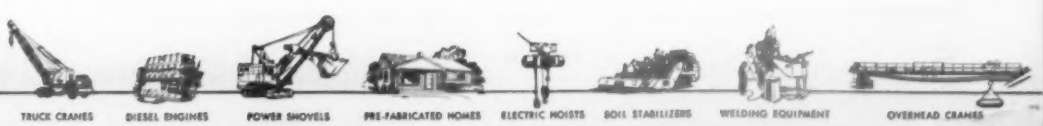
**You've heard P&H owners brag about what their machines will do. Isn't it time to find out for yourself? You've nothing to lose, much to gain in modern performance and lower costs.**

P&H POWER SHOVEL AND CRANE DIVISION
**HARNISCHFEGER CORPORATION**
MILWAUKEE 46, WISCONSIN

*See your P&H Dealer!*

**Look to P&H for the most modern features in Power Shovel and Truck Crane construction. There's all-welded design, live roller circle, triple-safe boom hoist, hydraulic control, plus a low center of gravity that provides a higher ratio of lifting capacity to gross weight. This means more WORKABILITY . . . BETTER PERFORMANCE . . . GREATER SAFETY. Write for literature on the size you need.**

The P&H Line



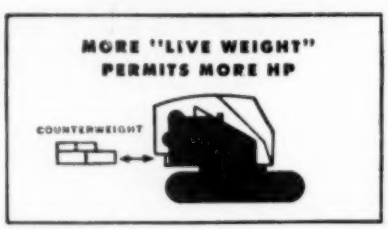
TRUCK CRANES · DIESEL ENGINES · POWER SHOVELS · PRE-FABRICATED HOMES · ELECTRIC HOISTS · SOIL STABILIZERS · WELDING EQUIPMENT · OVERHEAD CRANES

***Before you buy:***

# COMPARE NET HP!

This LS-85, despite tough, big-chunk rock, has been operating over 1200 hours without requiring one replacement part!

## Don't judge available power by engine model only ... NET hp is what adds up to extra profit!




COMPARE shovel-cranes with and without counterweight. That test spotlights the size, weight and heft built into the working parts and structural members. You'll find the LS-85 has more "live weight" than comparable ¾-yard shovel-cranes.

Greater net horsepower assures faster, deeper digging. Bigger loads are handled without stalling. For example: the diesel driven heavy-duty ¾-yard LS-85 packs 92 net hp. That's more power than comparably-sized competitive rigs can safely use. It's why the LS-85 has more digging force behind its bucket teeth . . . why it cuts so smoothly . . . hoists and swings without a pause.

Use of greater net hp is practical because of all-welded, stress-relieved construction *and extra "live weight."* This *extra live weight* is in heavier, sturdier working parts and structural members—rather than a heavier counterweight. All this means year-after-year service and low maintenance costs. So whatever you do, don't compare power by the engine model only—CHECK *NET* HP.

For more facts on the LS-85, ask your distributor, or write for Catalog 2317. For the complete line, request Catalog 2373.

**LINK-BELT SPEEDER CORPORATION**
**Cedar Rapids, Iowa**

13.248

**LINK-BELT SPEEDER CORPORATION**

BUILDERS OF A COMPLETE LINE OF CRAWLER, TRUCK AND WHEEL-MOUNTED SHOVEL-CRANES

**FACTORY-TRAINED DISTRIBUTOR SALES AND SERVICE SPECIALISTS ...*EVERYWHERE***

# The Star still shines...

And its light is reflected, millions upon millions of times over, in the eyes of children . . . in the minds and hearts of elders.

How wonderful that we may give the kindly remembrance, the helping hand, the loving thought, that constantly kindle that light anew!

Bemis

# 1,000 ABK METAL wheels keep conveyors rolling at Basic Refractories

The largest dead-burned dolomite kilns in the world, at Basic Refractories, Inc., are fed by conveyors that roll on 1,000 wheels cast in ABK Metal. They're ABK because they must give long, trouble-free service while moving through variations of heat in an atmosphere of abrasive dust that is encountered in every cement or associated operation.

The controlled structure of ABK Metal—a Brake Shoe exclusive—makes these nickel-chrome iron castings far superior to other iron castings of identical hardness. Extended life of 4 or 5 to 1 is not unusual when ABK Metal replaces parts made of comparable metals. This is especially true where abrasion resistance is of prime importance.

Cut the cost of abrasive wear in your mill by specifying ABK Metal castings. Their long life will mean extra savings to you through reduced replacement, less maintenance and downtime costs and increased operating efficiency.

QUALITY CASTINGS IN ABK METAL... MEEHANITE®... DUCTALLOY METAL

AMERICAN Brake Shoe COMPANY

Chicago • Houston • St. Louis • San Francisco • Toledo 1948

BRAKE SHOE AND CASTINGS DIVISION

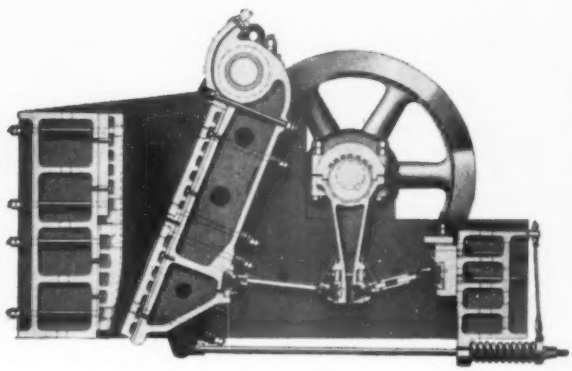
230 Park Avenue, New York 17, N. Y.

## DRY ROLLING TOGGLES ON A-C JAW CRUSHERS

# Last 4 to 6 Times as Long

## AS OLD TYPE JAW CRUSHER TOGGLES!

**ALLIS-CHALMERS**
**Jaw Crushers**



**FROM A ROCK AND SAND PLANT...**
Dry toggles installed 2½ years ago still going strong!

**FROM A CEMENT PLANT...**
After more than 2 years' operation, dry rolling toggles show relatively no wear!

**FROM A MINING COMPANY...**
New dry rolling toggles last 3 months, operating 24 hours a day. Old toggles lasted only 1 to 3 weeks!

**FROM A QUARRY OPERATOR...**
Dry rolling toggles installed 2½ years ago show very little wear.

**Users names on request.**

ACTUAL FIELD REPORTS show Allis-Chalmers dry rolling toggles (which are still in use) have already lasted *up to six times* as long as conventional toggles. No wonder crushing men are enthusiastic!

True rolling action of toggle ends and seats — instead of damaging sliding action — results in much less wear. Friction is eliminated — toggle ends operate cold even after a day's crushing.

Maintenance is less, too. No lubrication is required. Toggle ends operate dry. It's safer and cleaner around the crusher because there are no oil lines, no messy oil drip.

For more facts, get in touch with the Allis-Chalmers representative in your area, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

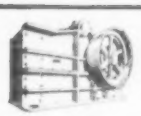
A-3824

# ALLIS-CHALMERS

**Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.**

Hammermills

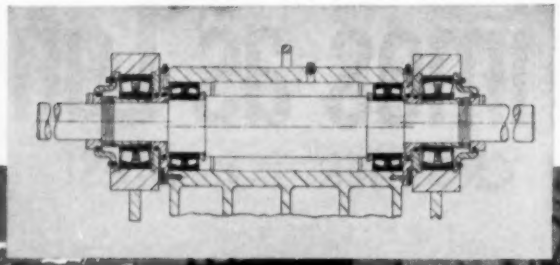
Vibrating Screens


Jaw Crushers

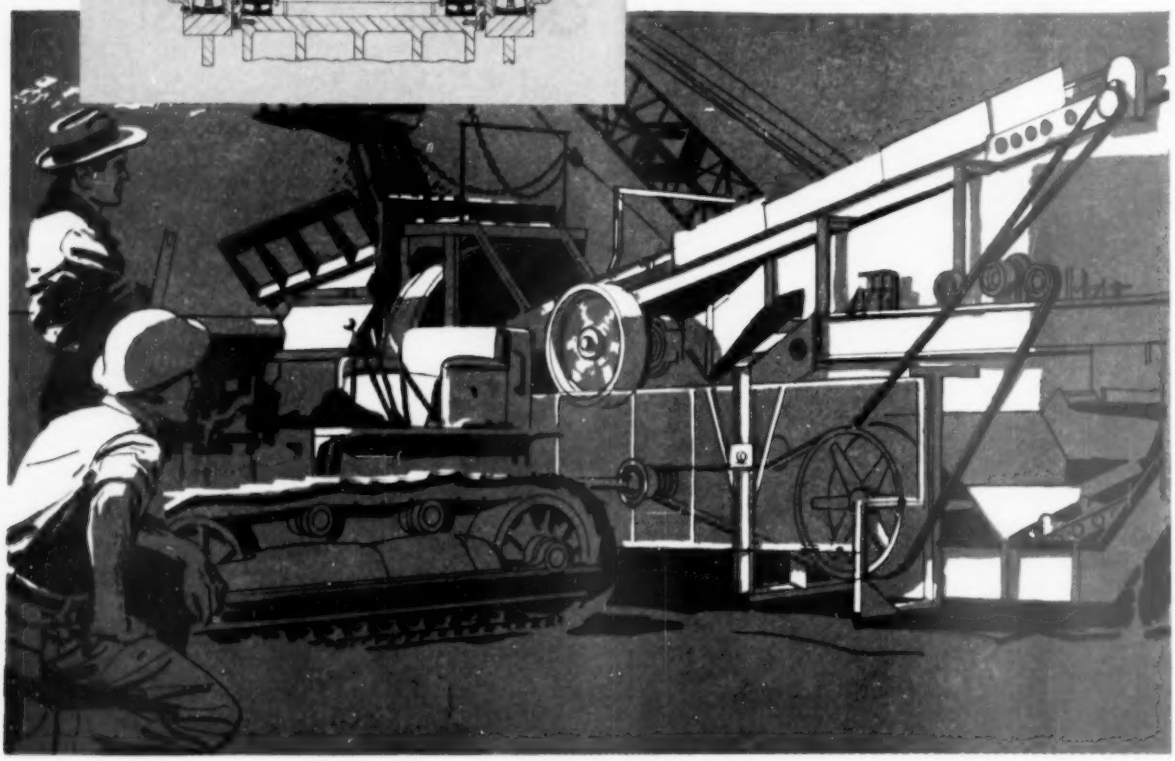
Gyratory Crushers

Grinding Mills

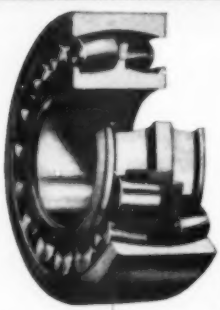
Kilns, Coolers, Dryers



*A 1036 jaw crusher, 30" x 24" roll crusher and 4' x 12' 2½" deck screen—all combined in a portable unit meeting state highway weight limitations—put the Universal Senior "R" Gravelmaster in a class by itself. Jaw crushers in many of these unique units operate with precision-ground, self-aligning TORRINGTON Spherical Roller Bearings.*



# Cutting Costs



# In Crushers!

TORRINGTON Spherical Roller Bearings are cutting operating and maintenance costs in scores of today's largest, most powerful crushers (see typical unit above). Here's how they do it:

First, TORRINGTON Spherical Roller Bearings are inherently self-aligning. They compensate for momentary deflections due to shock loads, run smoothly under severest working conditions.

Second, their high-conformity rollers and races are precision ground from the finest of heat-treated, bearing-quality steels. Friction is held to a practical minimum. Uniform hardness of all load-bearing parts gives longer bearing life.

Finally, one-piece, cast-bronze, land-riding cages (one for each path of rollers) assure accurate roller guiding, eliminate roller binding.

These cost-cutting features more than pay their way not only in crushers but also in pulverizers and vibrating screens, grinding mills and rotary kilns. So for *all* your heavy-duty applications, specify TORRINGTON Spherical Roller Bearings!

THE TORRINGTON COMPANY
South Bend 21, Ind. Torrington, Conn.

**TORRINGTON SPHERICAL ROLLER BEARINGS**

Spherical Roller • Tapered Roller • Cylindrical Roller • Needle • Ball • Needle Rollers

# When It Comes to
# POWER TRANSMISSION
## On the BIG JOBS
## Look to... Jones

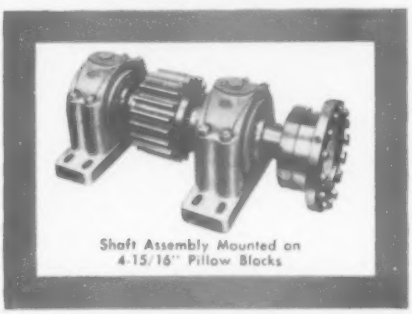
Cement Kiln Drive

**SPEED REDUCERS AND COMPLETE DRIVES TO 500 HORSEPOWER**

HERRINGBONE WORM GEAR WORM HELICAL

**JONES Products**—*While specifically* designed for the heavy industries — *are competitive for all applications.* All the added values of sturdier design, heavier construction and better materials are yours without extra cost.

***Ask for Bulletins***



Shaft Assembly Mounted on 4-15/16" Pillow Blocks

**PILLOW BLOCKS** to 9" Shaft Size

*Timken Equipped,* Adapter Sleeve Type
Self-Aligning, Dust-Tight
Sizes to 4-15/16" in Stock

Jones 60" x 57" Rubber Covered Pulley mounted on 9" Jones Timken Pillow Blocks

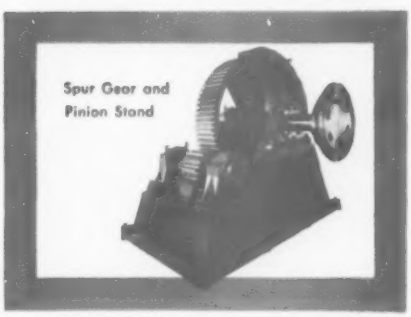
**CAST IRON CONVEYOR PULLEYS**

*Tailor-Made* to Your Requirements.

**CUT GEARS**

*to Your Specifications*

HERRINGBONE - WORM
HELICAL - BEVEL - SPUR



Spur Gear and Pinion Stand

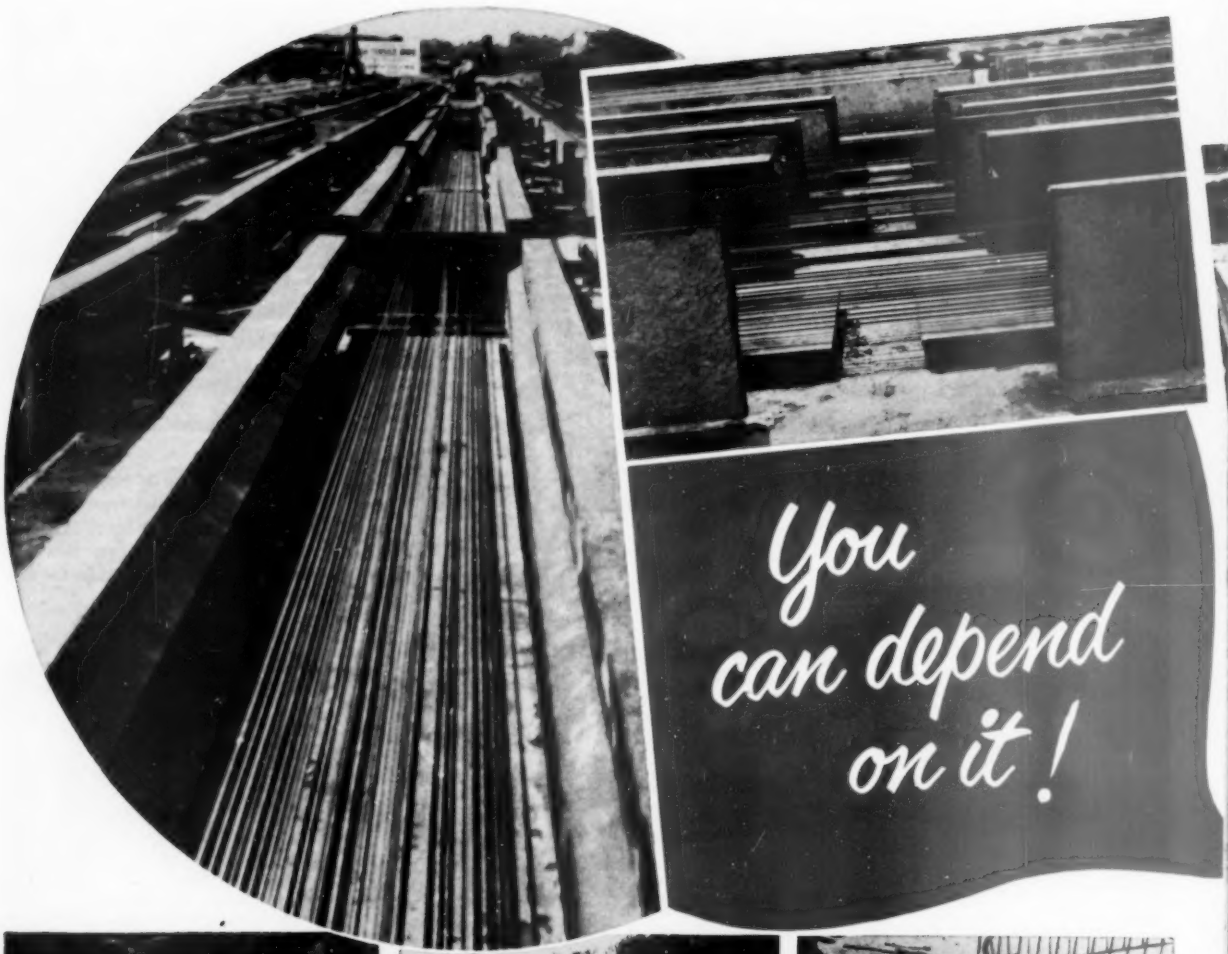
W. A. JONES FOUNDRY & MACHINE CO., 4447 W. Roosevelt Rd., Chicago 24, Ill.

*Since 1890*

Jones

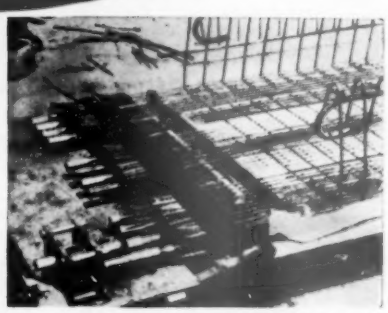
*In The Service Of Industry*

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
CAST IRON PULLEYS • CUT GEARS • V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS • FLEXIBLE COUPLINGS

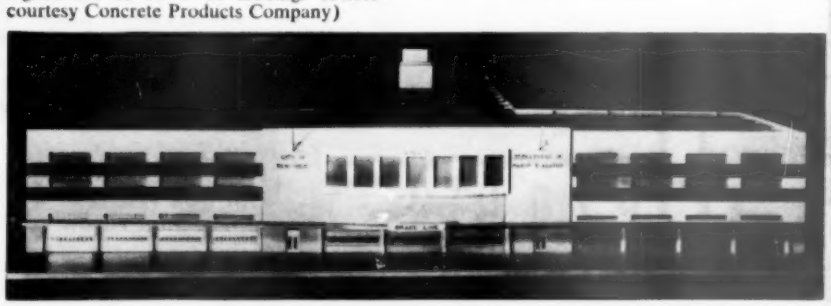


**THIS PRESTRESSED** high pressure concrete pipe line was installed at Hammond, Indiana, in 1939. Photograph shows installation of one of the earliest prestressed concrete pipe line installations in the United States. (Photo courtesy Price Brothers)

**THIS PHOTOGRAPH** shows the first pre-tensioned concrete bridge in the United States, erected in 1950 by Concrete Products Company of America. The Hockersville bridge, located near Hershey, Pa., was erected in 1 hr. 15 min., using American High Strength Reinforcing Strand. The bridge was designed for H 20 S 16 loading. (Photo courtesy Concrete Products Company)



**THIS PHOTOGRAPH** shows details of jack and anchorage of pre-tensioned wire on the Hockersville bridge. Note American Welded Wire Fabric used for stirrup reinforcement. This was a State Highway Project. (Photo courtesy Concrete Products Company)



**MODEL OF PIER 57,** New York City, now under construction using novel method of reinforced concrete box construction. Prestressed concrete stringers, incorporating American Super-Tens Wire will support the main deck. (Photo: Freyssinet Company, Inc.)

**THESE PICTURES** show the wire pattern, forms, and finished prestressed concrete stringers which are being used in the construction of New York's new Pier 57. American Super-Tens High Tensile Wire was prestressed by the Freyssinet Method.

# AMERICAN *Super-Tens* WIRE AND STRAND

## for Prestressed Concrete

EVER since the idea of prestressed concrete was introduced to the engineers of this country, American Steel and Wire Division has been producing high tensile wire and reinforcing strand for use in experimental and actual construction projects on prestressed concrete. Our long experience with steel wire and our research of this particular application have contributed substantially to the progress of prestressed concrete construction.

Our engineers have accumulated a vast amount of technical data in regard to pre- and post-tensioning problems and methods and the selection of the proper type of wire or reinforcing strand to achieve pre-determined stress requirements.

Our research has resulted in the production of U·S·S American Super-Tens Wire and Reinforcing Strand specifically designed for use in pre- or poststressed concrete. Whether you require high strength, high creep resistance, maximum ductility, good corrosion resistance, good concrete bonding qualities, easy handling or combinations of these qualities, we have or can design and produce the wire or strand you need. Our specially designed wire is being used in the great modern Pier 57 now being erected in New York City.

We welcome your inquiries as to the use of American Super-Tens Wire and Strand in the prestressed concrete applications you have under consideration. At your service, also, is the experience of our engineers to help you determine the proper, yet most economical, type and form of stressing materials to do your job best. Write for technical bulletins describing the properties of American Wire and Strand for Prestressed Concrete.

**AMERICAN STEEL & WIRE DIVISION**
**UNITED STATES STEEL CORPORATION**
**GENERAL OFFICES: CLEVELAND, OHIO**

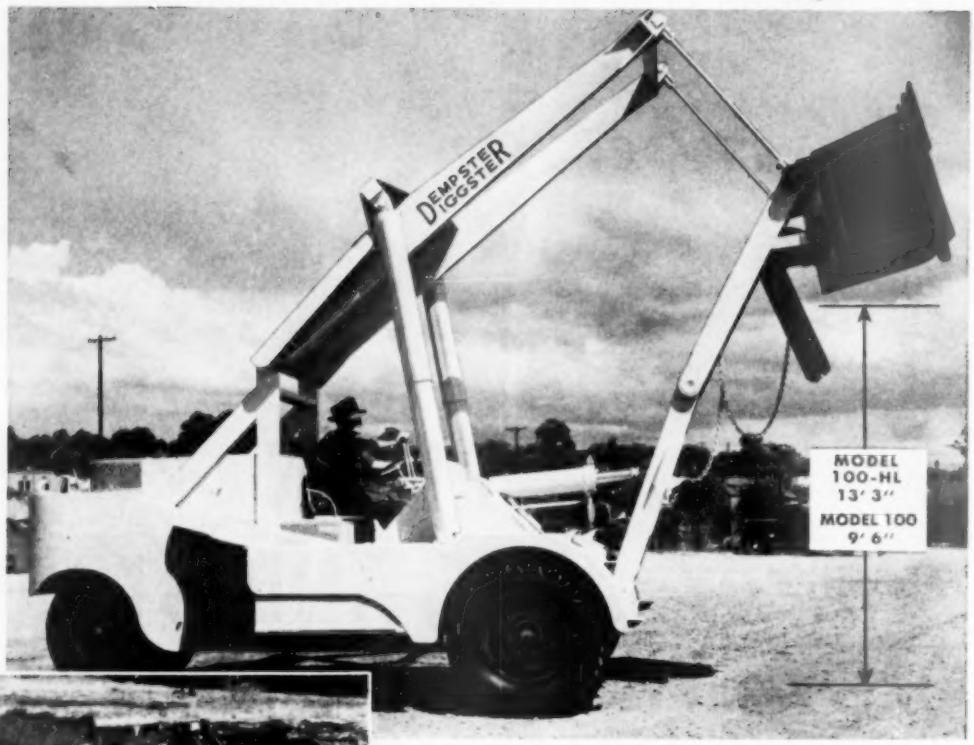
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

# U·S·S AMERICAN *Super-Tens* WIRE *and* REINFORCING STRAND

USS

UNITED STATES STEEL

# Power-Packed 100% Hydraulic Performance



*Large photo shows position of bucket when at extreme height above ground. Two small photos illustrate how, in excavation or loading, bucket follows slope of material—getting a full bucket with every stroke. Dempster-Diggster digs-in 15 inches below grade and digs out a 15 to 18 foot bank.*

## DEMPSTER-DIGGSTER OFFERS YOU BIG SHOVEL HYDRAULIC PERFORMANCE IN A SMALL, MOBILE UNIT...

**The Dempster-Diggster is the only small shovel that offers you all these basic and important features of big shovels—*Simultaneous and Independent Crowd and Hoist . . . Hydraulic Crowding . . . Hydraulic Hoisting . . . Variable Crowd Action at any Dipper Position . . . Changeable Buckets.***

**With these big shovel features, plus truck speeds on the job, and to and from jobs, the Dempster-Diggster enables you to speed up production for greater profits on jobs requiring excavation or loading!**

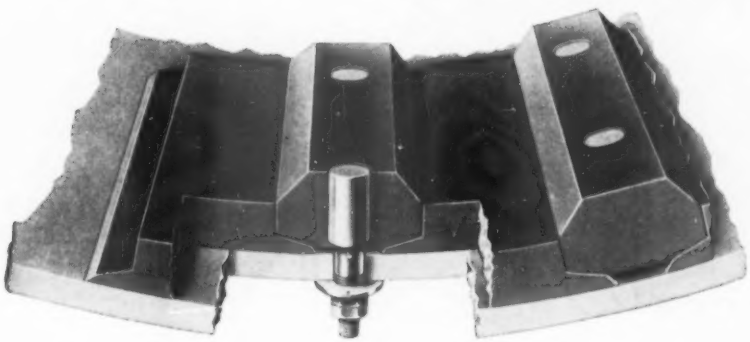
**Write for complete facts on this revolutionary, power-packed shovel. A product of Dempster Brothers, Inc.**

DEMPSTER DIGGSTER
TRADE MARK REG.

**DEMPSTER BROTHERS**
**3123 N. Knox, Knoxville 17, Tennessee**

# You can cut costs

## in your grinding operation with U·S·S Lorain Rolled Plate Linings



- Linings are in easy-to-handle sections, accurate sizes to permit quicker installation
- Plates can be heat-treated to compensate for localized wear
- Correct sizes make tighter joints . . . eliminate shell wash
- Lift bars are designed for correct cascade action . . . height of lift varied according to conditions
- Bolt supports located near the bottom of the bar . . . last for life of the lining

● You can do more and better grinding, for less money, with U·S·S Lorain Rolled Plate Linings. The output of your mill increases when the usable diameter increases, and this is just what happens when rugged Lorain *rolled steel* plates are used instead of ordinary castings. Lorain Liners can be much thinner due to their superior strength. Their lighter weight simplifies handling.

You save money with U·S·S Lorain Rolled Plate Linings because they are readily installed and require less maintenance. The plates are accurately made and are in easy-to-handle sections for ready use. Severe localized wear at feed or discharge end of the mill can be balanced by heat-treating. Lorain Liners are so durable that they remain serviceable until they're almost paper thin. You benefit from the use of the entire plate . . . there is less waste, longer wear. Mill down-time will be reduced and so will your upkeep costs.

The accurate size of U·S·S Lorain Rolled Plate Linings assures tight fit between the ends of the plates and between plates and lift bars, eliminating shell wash.

U·S·S Lorain Rolled Plate Linings are available—in the diameter, length and thickness best suited to your operating conditions—through leading mill manufacturers whose names will be furnished upon request.

**U·S·S GRINDING BALLS** are carefully made of special composition steel to take long, rough wear evenly. Samples from each production lot are thoroughly tested to make sure of surface hardness and maximum hardness penetration. They come in eleven sizes from $\frac{3}{4}$" to 5". For further information just return the coupon below.

United States Steel Corporation
Room 2819-U, 525 William Penn Place
Pittsburgh 30, Pa.

Without obligation on my part, please send me your FREE booklet on U·S·S Grinding Balls.

Name .....
Company .....
Address .....
City ..... State .....

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

# U·S·S LORAIN ROLLED PLATE LININGS AND U·S·S GRINDING BALLS

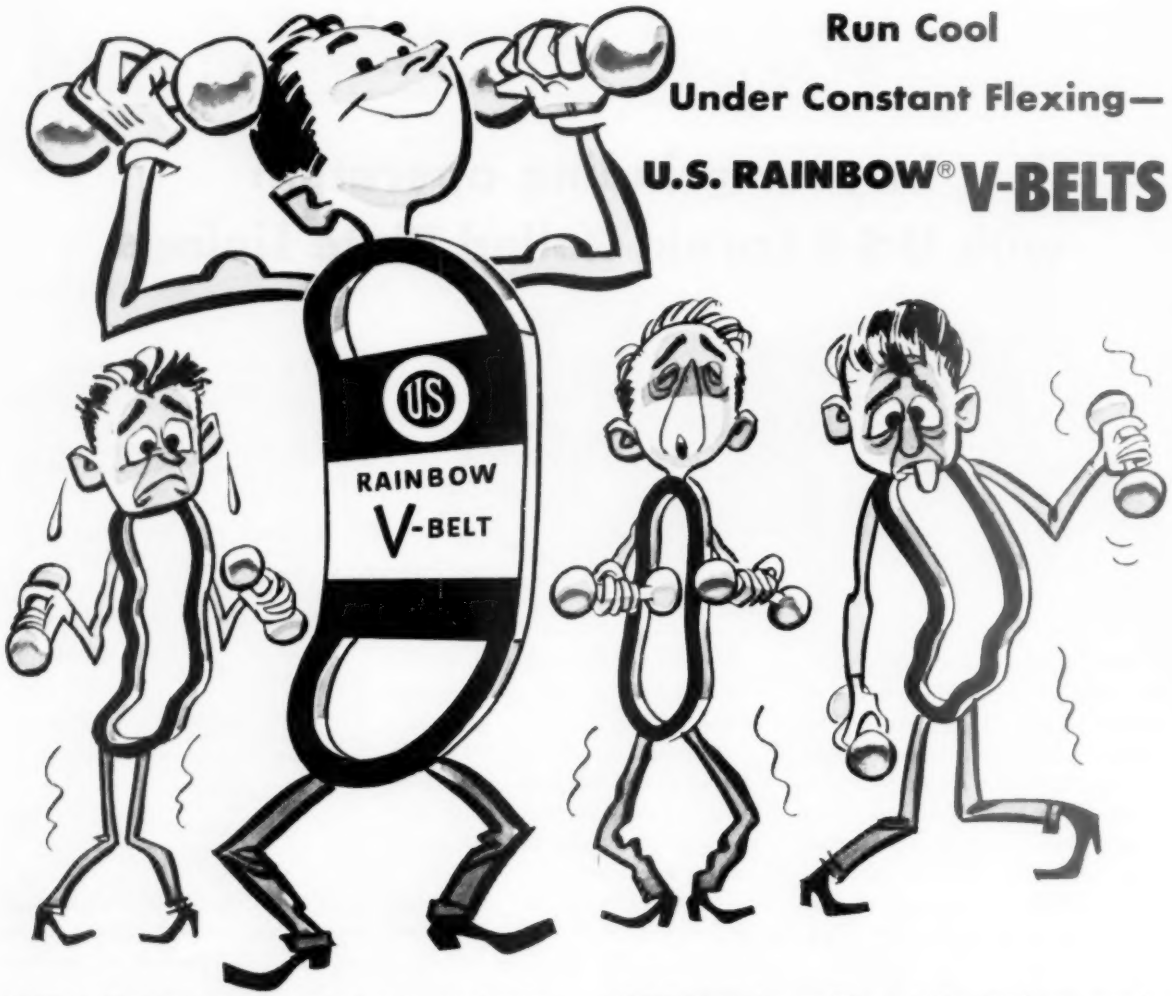
USS

9-2023

UNITED STATES STEEL

# Run Cool Under Constant Flexing—

# U.S. RAINBOW® V-BELTS




***Why U. S. Rainbow V-Belts are superior: No. 3 in a series.***

Why do U. S. Rubber V-Belts run so cool? Because the top and bottom sections have been specially built to reduce heat; specially compounded to provide elasticity, firmness and stability.

The pulling cords are specially latex-treated to reduce heat generated by constant flexing.

And every U. S. Rainbow Belt has U. S. Rubber's scientifically developed Equa-Tensil Cord Section that brings together the concentrated strength of the multiple pulling cords—distributes the pulling of the load so evenly among the cords that *each* carries its *full* share.

Order from your jobber, or contact any of our 25 District Sales Offices, or write to address below.

***Top rubber cushion*** *in closely engineered balance with the lower section . . . to keep cool under constant stretch and return.*
***Equa-Tensil Cord Section*** *— all cords scientifically placed, each pulling its share of the load.*
***A sturdy level cushion*** *for the Equa-Tensil Cord Section provides structural firmness for V-grooves and over the flat pulley of V-to-flat drives.*

**A COMPLETE DRIVE SERVICE**

**MULTIPLE V-BELTS • F.H.P. V-BELTS • SHEAVES**
**FLAT BELTS AND BELTING • SPECIAL PURPOSE BELTS**

U.S. RUBBER
SERVING THROUGH SCIENCE

*"U.S." Research perfects it.*
*"U.S." Production builds it.*
*U.S. Industry depends on it.*

**UNITED STATES RUBBER COMPANY**

**MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

**Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting**

# DEMONSTRATED...SOLD...REORDERED!

## "Eucs" Maintain 87% Job Availability at Norway Mine!

**AT Sydvaranger iron mine in Norway,** a Model TD 22-ton Rear-Dump "Euc" on demonstration worked with a fleet of tractor-trailer units of other make. Performance of this "Euc" and its 25% greater job availability was so impressive that seven additional Rear-Dump Euclids were purchased . . . the original hauling fleet is being replaced or converted to other use.

Working 24 hours a day, 6 days a week, the year 'round, "Eucs" at Sydvaranger have averaged 87% job availability including time required for periodic servicing and installation of special equipment. They are loaded with iron ore and heavy overburden by a 4½ yd. shovel, and have a round trip haul of about 3½ miles.

The simple but rugged design of job-proved "Eucs" is paying off at this mining operation 250 miles north of the Arctic Circle just as it is on hundreds of other mine, quarry and earth moving jobs throughout the world. Have your Euclid Distributor provide a hauling production and cost estimate based on the use of Euclids for your work . . . there's no cost or obligation.

**The EUCLID ROAD MACHINERY Co.**
Cleveland 17, Ohio

EUCLID (GREAT BRITAIN) LTD. • GLASGOW, SCOTLAND

# Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

# SHEFFIELD MOLY-COP

TRADEMARK REG.

COPPER-MOLYBDENUM-ALLOY

*Grinding Balls*

## Used and Proved All Around the World

Measure the price of your grinding balls in terms of highest possible production and the lowest cost per ton of material ground

Do this and you will join the ranks of mines, mills and cement plants, including some of the world's largest concentrators, who have standardized on Moly-Cop balls.

The Sheffield alloy, hot rolled, hot forged, slow cooled, reheated, sized and quenched—all by means of automatically controlled equipment—produces fine-grained, harder, tougher balls that wear longer and hold their spherical shape longer.

You benefit from lower ball costs per ton milled, fewer chargings, less handling and down time, greater grinding efficiency and reduced mill power consumption.

Sheffield engineers stand ready to prove the money savings advantages in your operation.

***Export Representatives:*** ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

**SHEFFIELD**
**STEEL**
**CORPORATION**
HOUSTON KANSAS CITY
TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION

# FLEXIBILITY! High Production!

10″ x 30″ Jaw Crusher | 36-5 Gyrasphere Crusher | 4′ x 12′ Vibro-King Screens | 20″ x 15′ Sand Classifier | 36″ x 25′ Sand Drag

4′ x 10′ two-deck Scalper Screen

## Tri-County Gravel Co.
## Sandyville, Ohio

24″ x 91′ Stacker Conveyor

## Producing Specification Aggregate with TELSMITH®

24″ x 5′ Standard Plate Feeder

Mr. I. J. LeBold, experienced and successful Ohio aggregate producer, recently purchased this Telsmith Engineered and Equipped Plant. It economically processes 100-125 tons per hour of sand and gravel to meet Ohio State Highway Specifications. Three sizes of gravel, two sizes of sand and a minus ¾″ road gravel are produced with only minor adjustments and, in cold weather, the plant can be changed from a washing application to a dry road gravel plant by flipping one gate. Get all-Telsmith plant story in Bulletin 266.

G-22

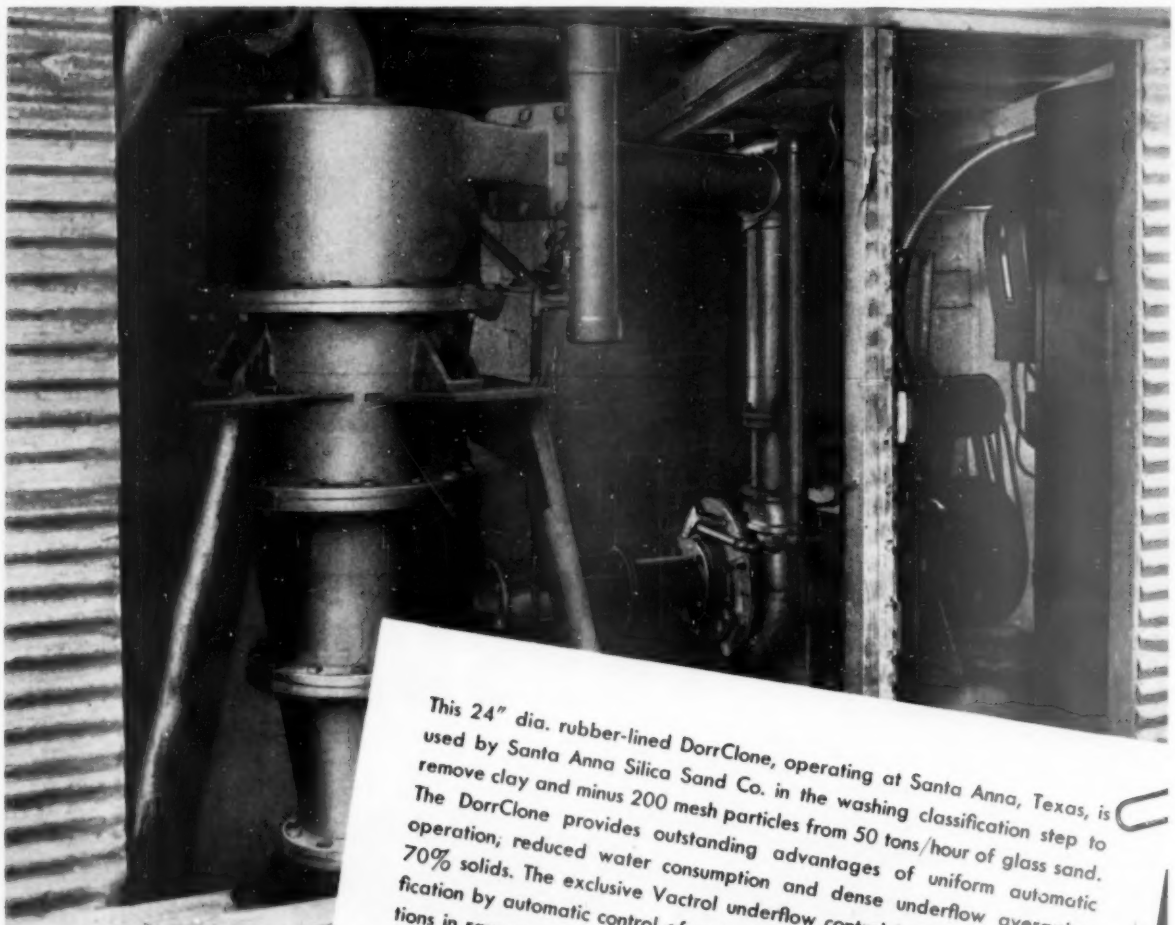
**SMITH ENGINEERING WORKS, 508 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN**

Cable Address: Sengworks, Milwaukee

51 East 42nd St., New York 17, N. Y. · 211 W. Wacker Drive, Chicago 6, Ill. · 712 Commercial Trust Bldg., Philadelphia 2, Pa. · 238 Main Street, Cambridge 42, Mass. · Barlett Equipt. Co., Milwaukee 3, Wis. · The McLean Co., 3155 Lakeside Ave., Cleveland 14, Ohio · Marcus Equipt. Co., Rochester, Mich. · Rist Equipt. Co., Cincinnati 14, & Portsmouth, O.—Charleston 22, & Clarksburg, W. Va.—Roanoke 7, & Richmond 16, Va. · Robert S. Bailey, 816 W. 5th St., Los Angeles 17, Calif. · Minor Eng. & Equipt. Co., San Francisco 4, Calif. · Clyde Equipt. Co., Portland 9, Ore., & Seattle 4, Wash.

# 50 tons-per-hour

## Silica Sand Washed by this DorrClone



This 24" dia. rubber-lined DorrClone, operating at Santa Anna, Texas, is used by Santa Anna Silica Sand Co. in the washing classification step to remove clay and minus 200 mesh particles from 50 tons/hour of glass sand. The DorrClone provides outstanding advantages of uniform automatic operation, reduced water consumption and dense underflow averaging 70% solids. The exclusive Vactrol underflow control insures smooth classification by automatic control of underflow consistency regardless of variations in raw sand feed rate or changes in size analysis of sand.

It will pay you to get the facts. Write for a copy of Bulletin No. 2501. THE DORR COMPANY, Stamford, Conn.
*In Canada:* 26 St. Clair Ave., E., Toronto 5.

DorrClone is a trademark of The Dorr Co., Reg. U.S. Pat. Off.

Better tools TODAY to meet tomorrow's demand

DORRCO

DORR

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

THE DORR COMPANY • ENGINEERS • STAMFORD, CONN.

Offices, Associated Companies or Representatives in principal cities of the world.

## "Plain Primacord will hug the Plastic in a tight double hitch...

"I use Plastic Reinforced Primacord for unusual wet conditions, and in deep holes, or wherever field shots must stand a long time before blasting. It has a tough, plastic cover and will take a lot of punishment. It is not affected by high summer heat or winter cold.

"I use a trunk line of flexible Plain Primacord and make a double half hitch around the Plastic Reinforced branch line at a right angle, like this. The textile covered Plain Primacord grips securely in a tight double loop around the plastic cover without slipping.

"Tight right-angle Primacord connections all along the line go a long way toward giving you a good shot every time."

*Ask your explosives supplier or write for further facts to*

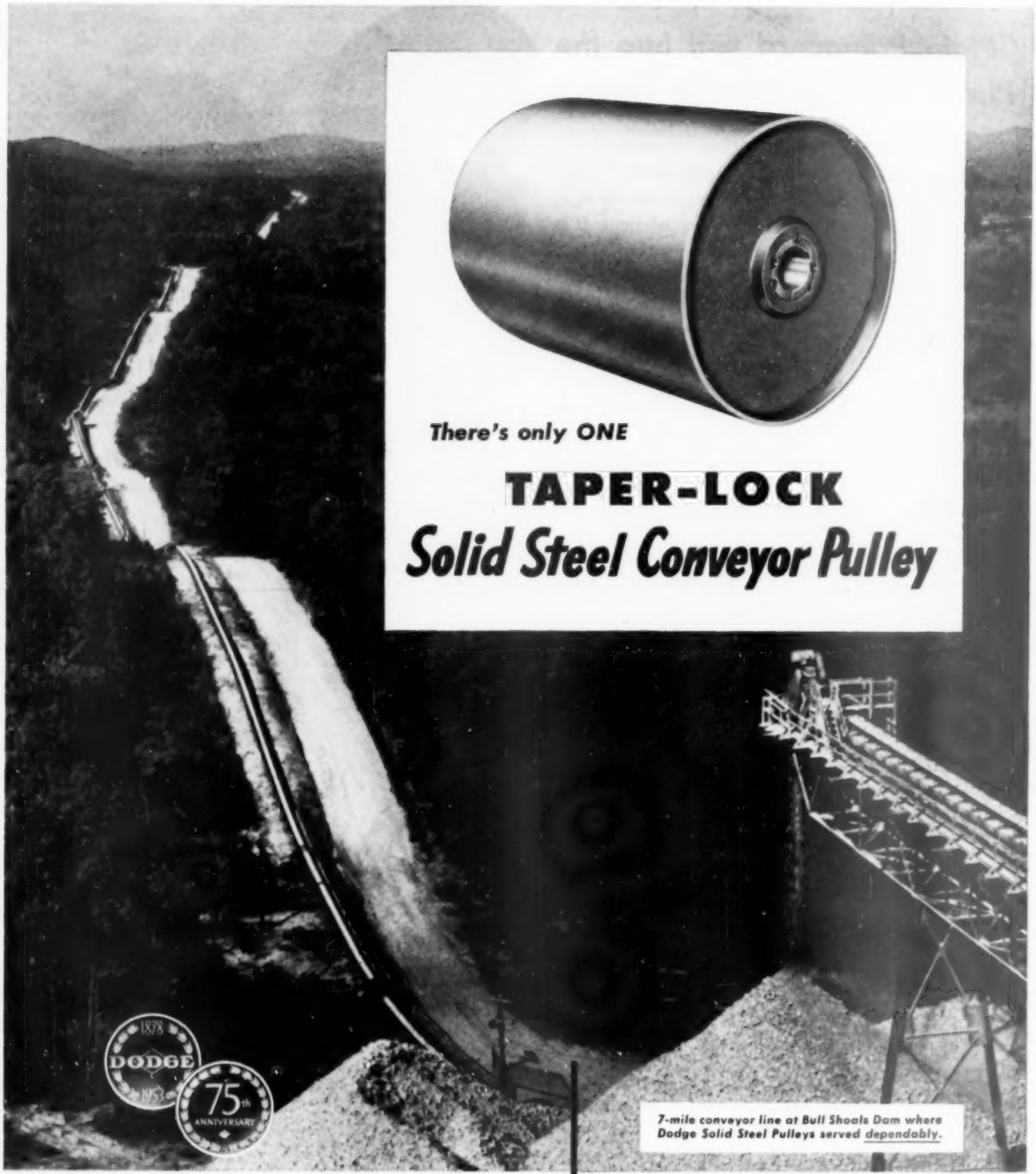
**THE ENSIGN-BICKFORD COMPANY**
**Simsbury, Connecticut**
***Also Safety Fuse Since 1836***

Here **Plastic Reinforced Primacord** is used for the branch line, and **Plain Primacord** for the trunk line. Note the double half hitch around the plastic cover. It pulls up tight and stays that way.

Other brands to serve your needs are: **Reinforced Primacord,** for deep holes and resistance to abrasion; and **Wire Countered Primacord,** for deep, ragged holes.

P-3

# Use PRIMACORD
## The PROVED and APPROVED DETONATING FUSE



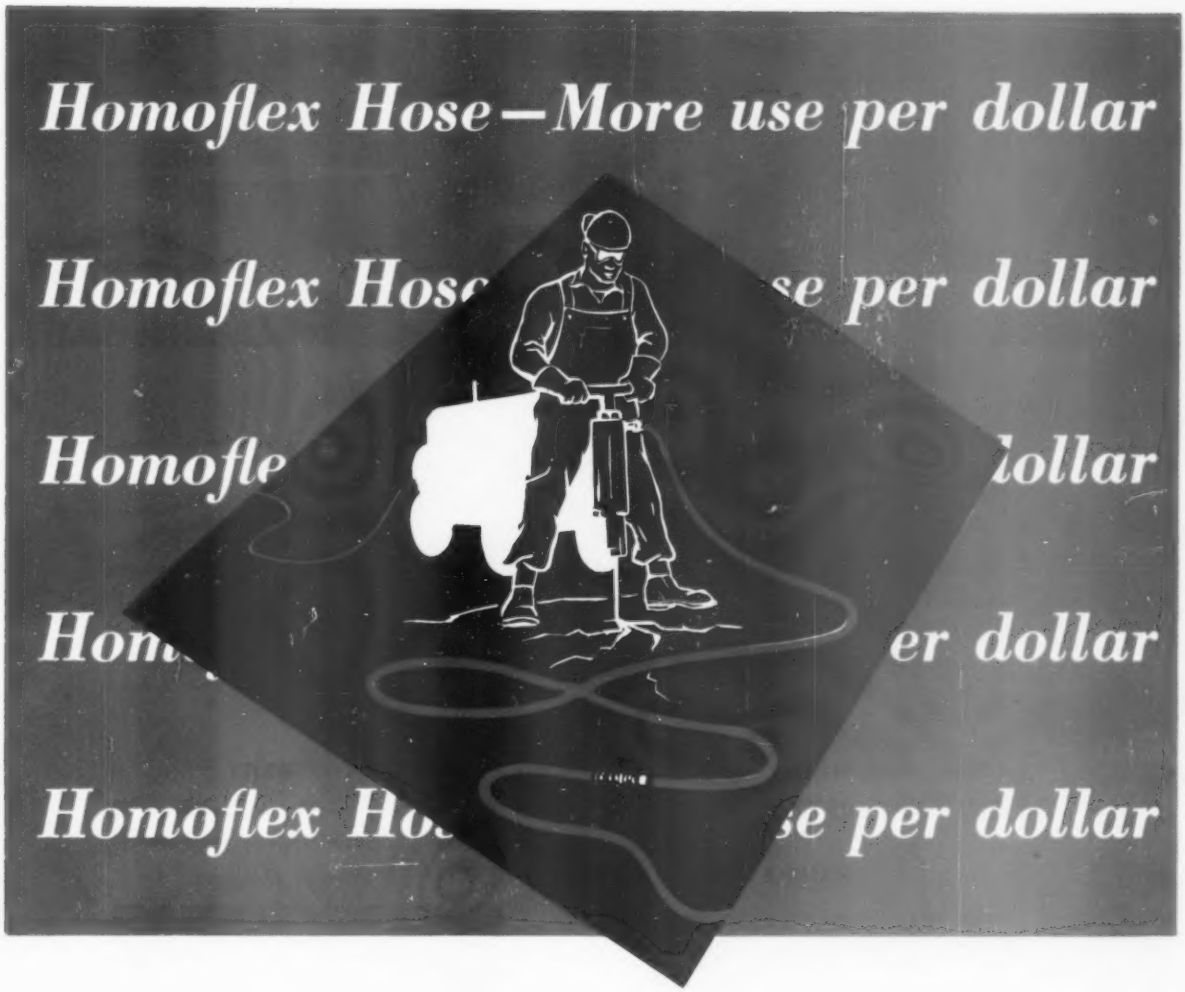

The famous TAPER-LOCK Bushing in the Dodge Solid Steel Conveyor Pulley gives you the equivalent of a shrunk-on fit—and greatly simplifies the job of mounting and de-mounting! The drum type construction of this modern product provides maximum strength with minimum weight. Accurately formed; *uniform* rim thickness. Fully enclosed to exclude dust, dirt, water. Diameters 6 in. to 8 ft., all face widths. Popular sizes stocked by our distributors.

**DODGE MANUFACTURING CORPORATION, 2600 Union St., Mishawaka, Indiana**

**DODGE**

*of Mishawaka, Ind.*

***CALL THE TRANSMISSIONEER,*** your local Dodge Distributor. Factory-trained by Dodge, he can give you news of cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

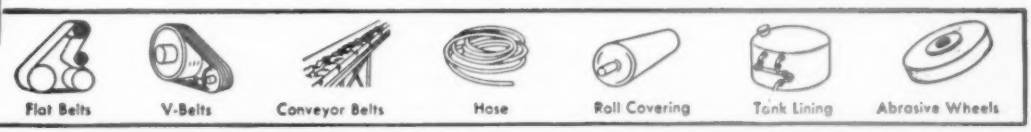



**FLEXIBLE, LIGHT, BUT RUGGED AND STRONG . . .** Yes, you save money because Homoflex lasts longer. It's easier to coil and uncoil . . . no pre-set twist . . . no kinking . . . easier to carry and drag. "Flexible as a Rope". Workmen like it. Cover and tube are inseparable and hosewall is strong and safe, for handling air, water, other fluids and gases. Ask the R/M distributor for Bulletin 6879. He'll tell you about other R/M hose types for steam, oil, suction, chemicals—from small 1/4" size, to huge dredging hose big enough for a man to crawl through . . . also how you get MORE USE PER DOLLAR with R/M transmission, and conveyor belt, and V-belts.

RM

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

**RAYBESTOS-MANHATTAN, INC.**




Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

# Compare!

## THESE MODERN BUCYRUS-ERIES WITH OTHER SHOVELS

### BOOM

Two-section — light upper section, rugged lower section. No excess weight. Weight and strength concentrated where needed and close to center of rotation.

Lower boom section integral with rest of machine, through twin strut connections to A-frame. Boom feet wide spread — no sway braces or cables. No boom jacking.

### HANDLE

Single, tubular, one-piece, can rotate in saddle block. No handle twist possible.

### SADDLE BLOCK

Cylindrical. Rubber cushioned against impact during fast plugging of swing. No binding with flexed dipper handles.

### CROWD MACHINERY

Located forward on revolving frame, close to center of rotation. Position reduces swing inertia. Accessible, protected.

### TYPE OF CROWD

Quiet, positive, independent rope crowd and retract. Adapts itself to tubular handle rotation — low friction — less crowd power required.

### TYPE OF HOIST

Twin dual, single-part hoist ropes, one attached to each side of dipper. Power automatically concentrated where needed on dipper lip to break through bank obstructions. No dipper bail.

### CONVERTIBILITY

Shovels fully convertible to draglines of the independent motor type — no operating clutches or brakes.

**THESE FEATURES ADD UP TO . . .**

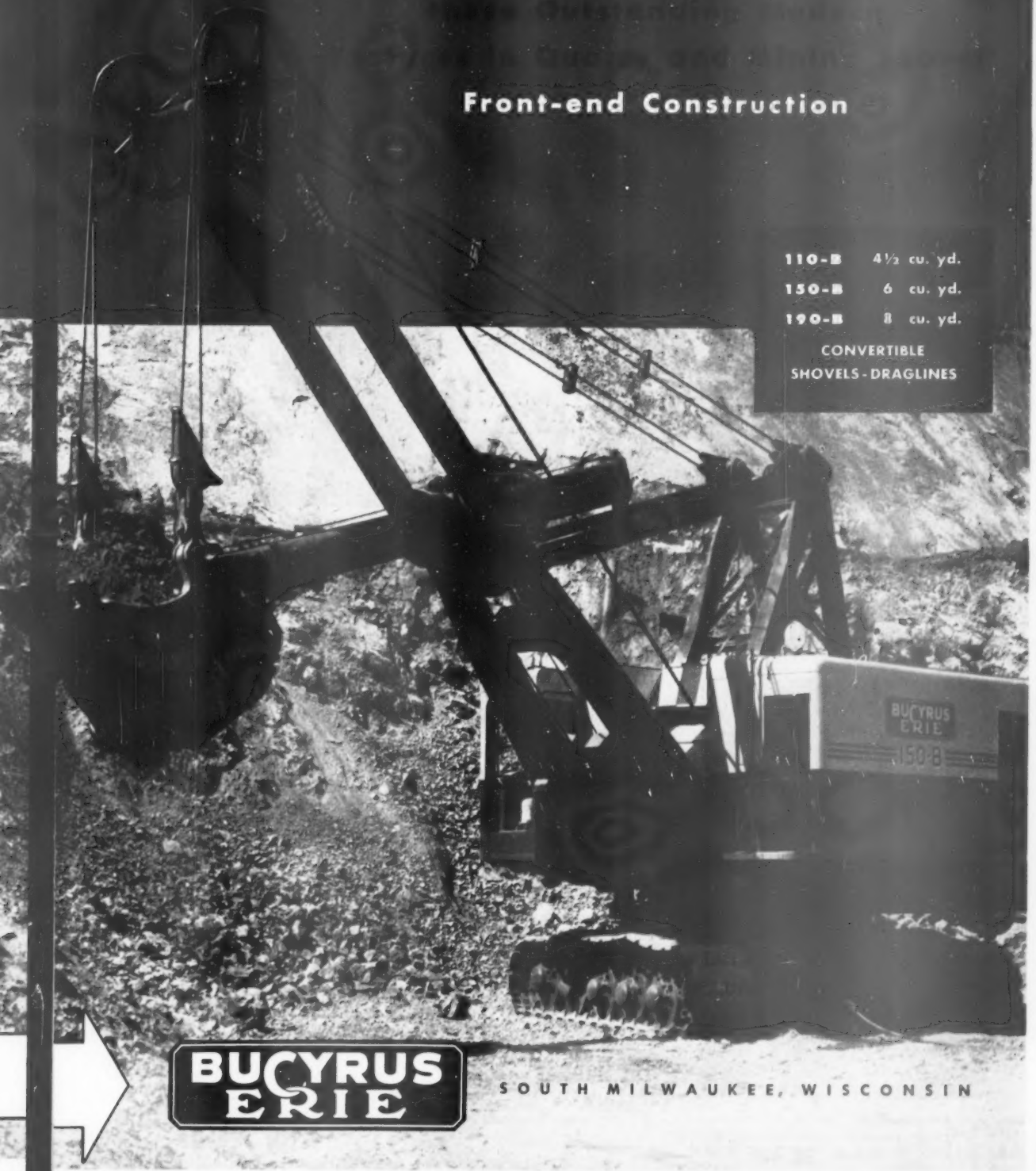
- **BIGGER DIPPERS PER POUND OF SHOVEL WEIGHT**
- **MORE OUTPUT**
- **LESS DOWN TIME**
- **LOWER OPERATING COST**
- **BROADER APPLICATION**

42L53C

THERE ARE MANY MORE REASONS WHY THESE MODERN BUCYRUS-ERIES ARE THE FINEST QUARRY AND MINE EXCAVATORS EVER BUILT. GET THE FULL STORY TODAY.

# BUCYRUS-ERIE OFFERS

## Front-end Construction




| | |
|---|---|
| 110-B | 4½ cu. yd. |
| 150-B | 6 cu. yd. |
| 190-B | 8 cu. yd. |

CONVERTIBLE
SHOVELS - DRAGLINES

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

*Pinellas Industries, Inc.*

# Builds new plant around 5 belts reinforced with Du Pont "Cordura"

**Reinforced with "Cordura"**, the belt in foreground (24" x 598 ft.) dumps sand from the central stockpiles onto another reinforced belt (24" x 592 ft.) which carries it to batch bins.

The modern plant of Pinellas Industries, Inc., of St. Petersburg, Florida, is designed and built around a system of five conveyor belts, all sinewed for extra strength with Du Pont Cordura* high tenacity rayon.

The belts carry sand, stone and crushed granite (1) from hopper cars up to a distribution structure, (2) along a shuttle conveyor to central stockpiles, (3) through a tunnel below grade, (4) up to batch bins for ready mix and blocks, and (5) to a fifth belt serving the pipe plant batch bin. Manufactured by the Acme-Hamilton Rubber Company the belts handle moist materials . . . operate in heavy showers and hot sun.

Quarry operators have found that the low stretch strength of "Cordura" permits belts that are stronger, yet thinner and flexible for better troughing and training. Downtime for take-ups is reduced to a minimum.

Before you order your next conveyor belt, be sure to inquire about the use of "Cordura" rayon in belts. We'll send you the names of suppliers... together with full information about "Cordura". Just write for your free copy of "Sinews for Industry". Address: Textile Fibers Dept., Room 2520-R, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

**Du Pont "Cordura" High Tenacity Rayon**

STRENGTH AT LOW COST

*Watch "Cavalcade of America" on Television*

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Elmhurst-Chicago Stone Company Report on
J&L Jalloy Heat-Treated Plate:

# "Twice the Wear ... No Downtime During Quarrying Season"

Faced with the problem of finding a long-lasting lining for their high-speed rock-crusher chutes, Elmhurst-Chicago Stone Company tried everything from rubber to high-carbon steel. Then, in 1949, J&L Jalloy Heat-Treated Plate was experimentally installed in 15% of the company chutes.

Today all worn out plates have been replaced with J&L Jalloy. Here's why. Jalloy lasted twice as long as the special abrasion-resistant steel chute liners previously used ... Jalloy lasted the entire quarrying season ... eliminated costly downtime for maintenance repairs. Finally, Elmhurst has taken further advantage of this modern J&L mining and quarrying steel by installing Jalloy liners in the company's truck beds.

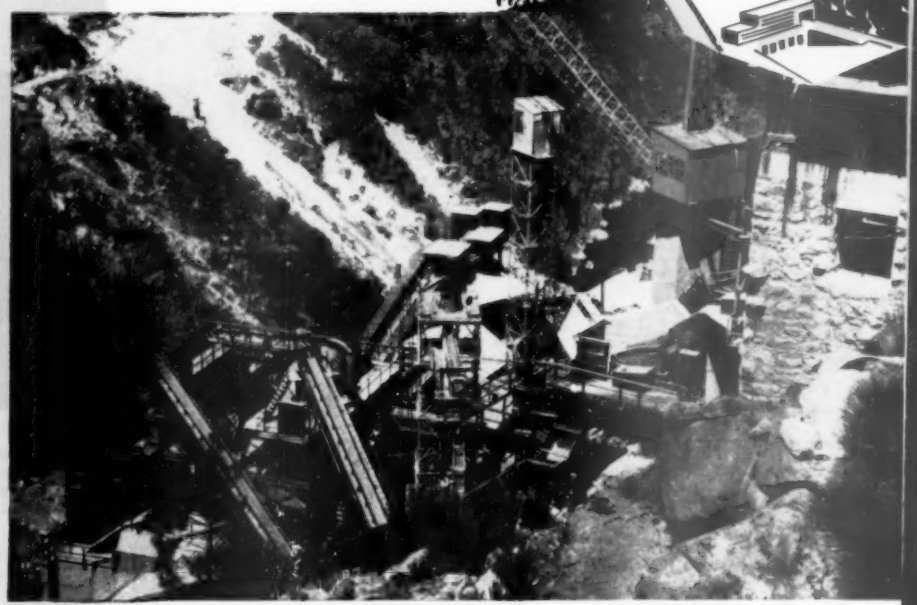
If you have equipment like this that takes a real beating from impact and abrasion — J&L Jalloy Heat-Treated Plate can help you cut maintenance costs and increase service life.

Developed specifically by J&L for heavy duty applications, Jalloy is a heat-treated, fine-grain, manganese molybdenum steel with both yield strength and Brinell hardness 4 times as great as mild steel. As a result, J&L heat-treated Jalloy lasts 4 times as long as mild steel — yet costs only twice as much.

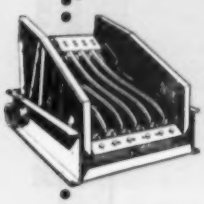
One of the roll crushers. Its high speed introduced tough impact and abrasion problems which have been solved with J&L Jalloy chute linings.

The 70-year-old quarry of Elmhurst-Chicago Stone Company.

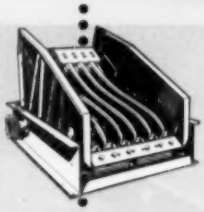
# *Portugal's CABRIL DAM and POWER STATION*
## another major project using NORDBERG equipment throughout

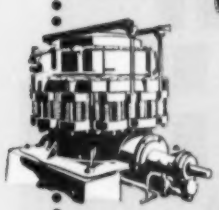


30" Nordberg-Symons Primary Gyratory Crusher

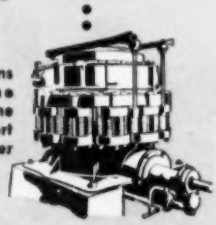


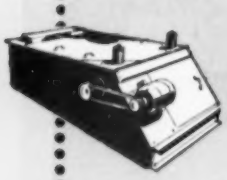
Two 42" x 5' Symons Vibrating Bar Grizzlies

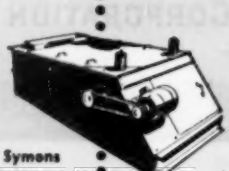




One 4¼' Symons Standard Cone Crusher and One 4' Symons Short Head Cone Crusher







Two 3' x 8' Symons Rod Deck Screens

Q253

*NORDBERG Machinery and "Know-How" again selected for another important project . . .* this time by *HIDRO-ELECTRICA do ZEZERE,* of Lisbon, for the construction of the new Cabril Dam and Power Station, in Portugal.

Major equipment supplied by Nordberg for this installation includes a 48" Apron Feeder; a 30" Symons® Primary Gyratory Crusher; a 4¼' Symons Standard Cone Crusher; a 4' Symons Short Head Cone Crusher; two Symons Vibrating Bar Grizzlies; and two Symons Vibrating Rod Deck Screens.

The outstanding success of this modern Nordberg equipment has been amply proved by the many statements of complete satisfaction written by the engineers and supervisory personnel connected with the Cabril Dam project.

Here, then, is further evidence that for large or small operations—including mineral reduction, base or precious metals, public works projects, or commercial aggregate production—you can depend on NORDBERG EQUIPMENT to deliver maximum output at lowest possible cost.

*Write for further information on the equipment you need.*

*"SYMONS" . . . A NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD*

**NORDBERG MFG. CO., Milwaukee, Wisconsin**

NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

# there's a *BIG* difference ...in this 3/4 yd. shovel!

**Look** beyond the dipper size when you investigate your next 3/4-yard shovel. Shovels may be rated the same, may even look alike, but that's where it ends when you look at a Lorain TL-25.

**Look** into the cab to see if power flows directly and efficiently from the engine to the point of use, as it does on the "TL-25".

**Look** to see if it has a great quantity of duplicate and interchangeable parts . . . does it have "packaged components" to permit quick switching of all major components. The "TL-25" has them.

**Look** at what these "TL-25" features mean on the job. If you believe *actions speak louder than words,* you'll like the "TL-25" because it really shines on field performance. We'd be glad to show you the proof of these statements.

**THE THEW SHOVEL CO., LORAIN, OHIO**

### 3/4 yards of power *plus* . . .

Whether gas or diesel, it goes to work directly . . . tears into the job . . . and turns out profit-earning yardage.

### 3/4 yards of speed *plus* . . .

You can capitalize on every bit of "TL-25" power because in operation it responds with lightning speed, has high acceleration that kills "drag", and is a muscle-saver for the operator.

### 3/4 yards of endurance *plus* . . .

Anti-friction bearings, oil-enclosed gears, 5 identical shoe clutches, drop-forged hook rollers . . . and other items of highest quality materials and workmanship assure "TL-25" stick-to-it-iveness on the job.

### 3/4 yards of selection *plus* . . .

No other machine in *any* class offers such a selection of booms and mountings to hit your job right-on-the-button. Select from 4 crawler sizes, 7 rubber-tire mountings, 7 interchangeable booms.

THEW LORAIN®

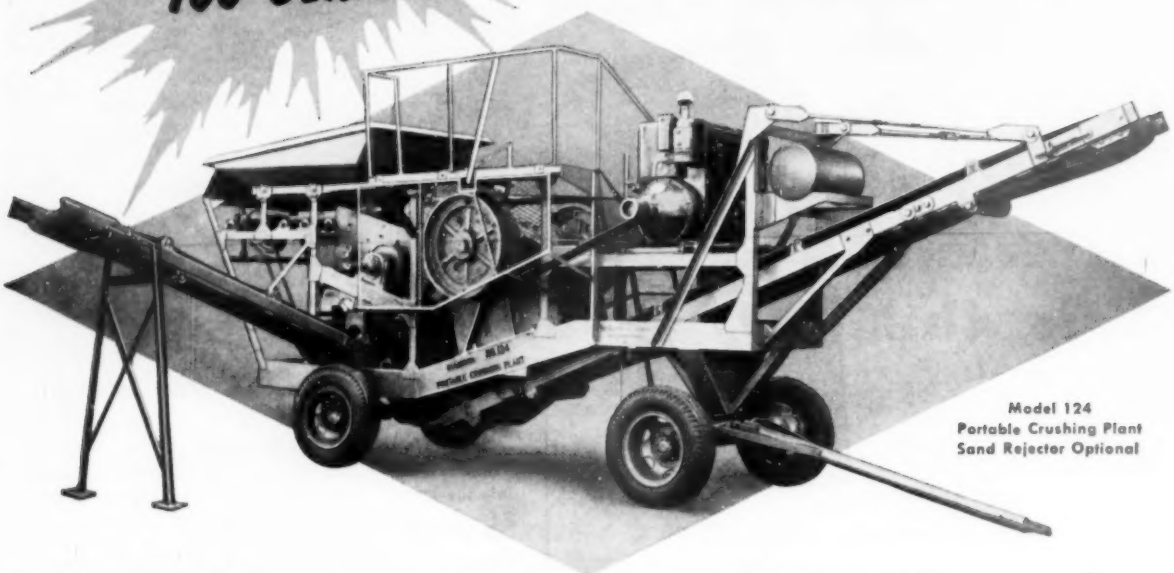
TL 25

**SHOVELS • CRANES • DRAGLINES • CLAMSHELLS • HOES**

ANNOUNCING 3 NEW MODELS IN THE 100 SERIES

# DIAMOND *Single pass*

## PORTABLE CRUSHING PLANTS



Model 124
Portable Crushing Plant
Sand Rejector Optional

## 3 MODELS... capacities from 30 to 70 tons/hr.

Designed for frequent moving, quick set-up and knock-down to give you more efficient crushing *where* you want it—*when* you want it. Ideal for counties and townships, secondary and access road construction, and areas where a high degree of mobility is needed. Low hopper height (10' 4½") gives ease of loading with ½ or ⅜ cu. yd. shovel. Heavy Duty Grizzly openings give higher crusher production with minimum of scalping. Location of wheel bar tongue and short wheel base provides needed maneuverability on road or in pit. Hinged delivery conveyor eliminates dismantling for towing. Mechanical or air brakes and fully guarded drives mean added safety. Adjustable single eccentric plate feeder provides a constant, even flow of pit run material.

Completely modern in every way, the Diamond Portable Crushing Plant is your answer to more efficient crushing.

### OUTSTANDING FEATURES

1. Highly portable
2. Controls centrally located
3. Low loading height
4. Low traveling height
5. Light in weight
6. Heavy in production
7. Clutch operated feeder
8. Oversized vibrating screen
9. Sand rejector (optional)
10. Power unit plant mounted

**FREE** Get the facts and specifications that tell you how a Diamond Portable Crushing Plant will increase your production. Send for new Single Pass Gravel Plant Bulletin 1000.

*Everything...* for the aggregate producer

**DIAMOND IRON WORKS, CO.**
AND THE MAHR MANUFACTURING CO. DIV.
1210 N. 2ND STREET, MINNEAPOLIS 11, MINNESOTA

Select the best for each particular purpose from among the many Harbison-Walker types and classes especially adapted for all the various factors and conditions involved in the operation of rotary cement kilns.

*Brands with long life records*
*Basic Refractories for High Temperature Zones*

MAGNECON—THERMAG—MAGNEX

*Leading High-Alumina Brands*

ALUSITE 70% Alumina—ANCHOR 60% Alumina—CORALITE 80% Alumina

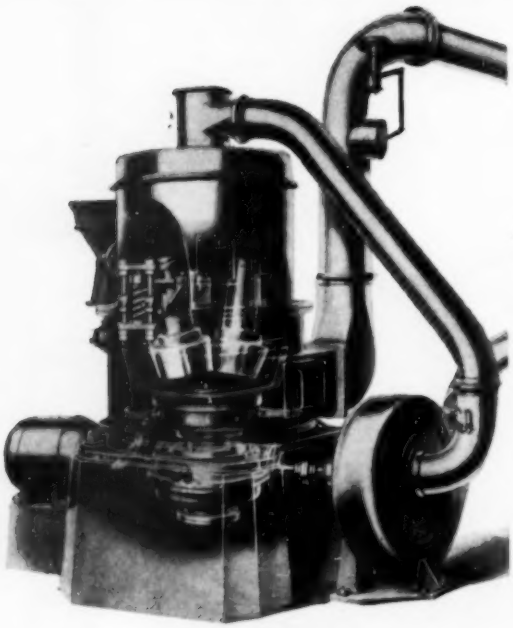
Various high duty and super-duty fireclay brick brands of superior quality are available from plants which afford lowest transportation costs—Pennsylvania—Missouri—Ohio—Alabama—Texas—Kentucky.

—and the outstanding abrasion resistant refractories—DURO and WYLAM A.

—as well as all classes of Plastic Fire Brick, Castables, Mortars and Cements and Insulating Refractories.

**Harbison-Walker Refractories Company**
AND SUBSIDIARIES
**WORLD'S LARGEST PRODUCER OF REFRACTORIES**
*General Offices:* 1800 Farmers Bank Bldg., Pittsburgh 22, Penna.

# If it's a Fine Grinding Job-



## RAYMOND BOWL MILL

**THIS modern, high-availability, direct firing unit handles coal of any grade, grindability or moisture content . . . and is capable of continuous 24-hour operation for extended periods without shutdowns.**

**Its responsiveness to load changes . . . ease of control and adjustment while running . . . smooth noiseless operation . . . record low maintenance . . . are advantages that help to reduce overall cement production costs.**

**Today, there are over 275 Bowl Mill installations with a total rated capacity of more than 12 million tons annually, firing rotary kilns in the cement, lime and dolomite fields alone.**

## RAYMOND VERTICAL MILL

For the economical production of high-fineness materials in sub-sieve sizes. Many types of products can be reduced to 95% to 99% finer than 15 to 20 microns, and some soft materials finer than 5 to 10 microns.

## MECHANICAL AIR SEPARATOR

Equipped with revolving whizzer blades to maintain maximum efficiency and uniformity in classifying powdered products. When used in closed circuit grinding operations, the Raymond Separator increases capacity of the mill unit from 25% to several hundred percent.

*Bulletins* ON REQUEST

# COMBUSTION

**RAYMOND DIVISION**

# RAYMOND has a Mill for it

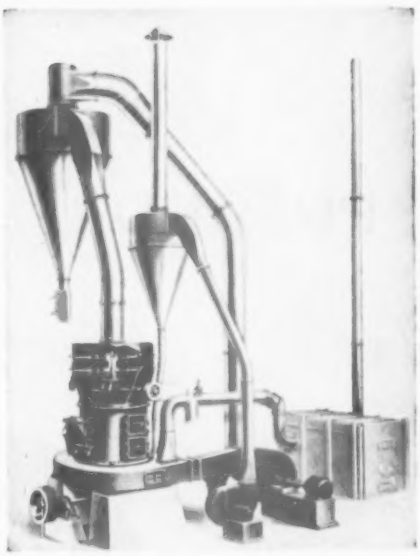
RAYMOND equipment offers a wide selection of pulverizing and separating units of the most modern type to meet your production requirements.

***Capacities:*** Raymond Mills are built in a full range of sizes, producing from a few hundred pounds per hour up to 30 tons or more per hour of finished material with the Super Roller Mills.

***Finenesses:*** Equipped with Air Separation, Raymond units may be adjusted to deliver uniform materials from 20-mesh up to 99.9% passing 325 mesh or finer.

***Moisture Removal:*** With the use of Flash Drying accessories, Raymond Mills can do a complete job of drying, grinding and classifying in one continuous, automatic operation.

Raymond installations are practically made-to-order, so that the type and size of mill with collectors and piping are designed to fit your plant layout and meet your production needs.

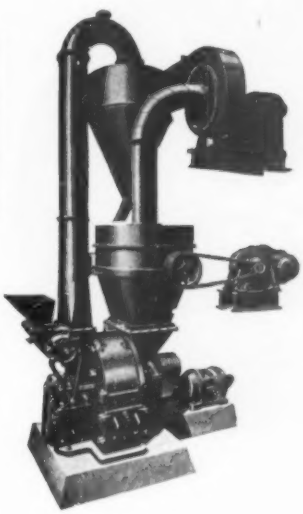


**RAYMOND ROLLER MILL**

Shown with double whizzer separator and flash drying accessories for removing moisture while grinding the material.

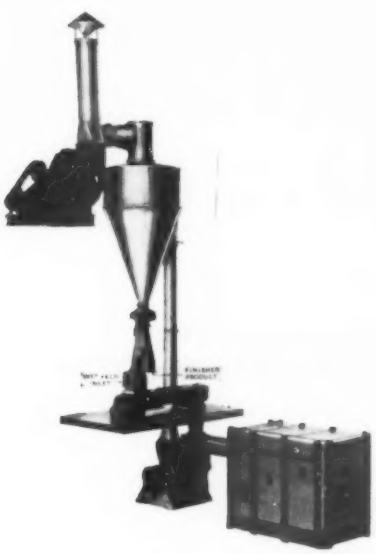
**ENGINEERING SERVICE**

Our more than sixty-five years of experience is available to you. Write us in detail about your grinding problem . . . and let us recommend the proper equipment to do the job.



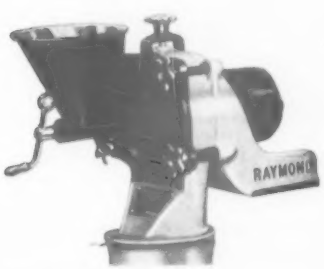
**RAYMOND IMP MILL**

Equipped with Whizzer-type separator for finish grinding operations on medium soft materials.



**RAYMOND CAGE MILL**

with Flash Drying System for disintegrating, drying, cooling and delivering a uniform finished product.



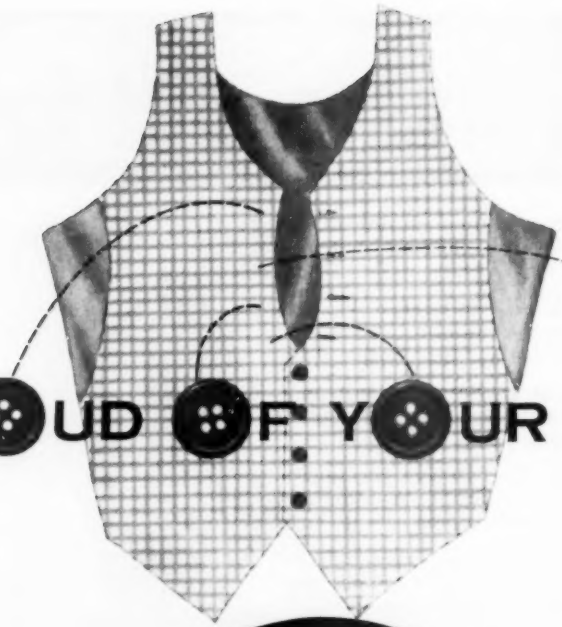

**RAYMOND LABORATORY MILL**

A complete motored unit for test runs and for the development of new products.

## ENGINEERING, Inc.

**1307 NORTH BRANCH STREET • CHICAGO 22, ILLINOIS**

***Sales Offices in Principal Cities***



# PROUD OF YOUR PRODUCT?

## Prove it with CHASE MULTIWALL Paper Bags

Prove it to Your Distributors and Dealers...

Prove it to Your Consumers

Prove it to Your Balance Sheet

Are you proud of the high quality of your rock products?

You *can* give *visible* evidence of superiority by packaging in CHASE Multiwall bags. This *preferred* bag is backed by 107 years of CHASE experience...experience in developing the finest material and workmanship...experience in fine printing...experience in Multiwall bag manufacture that assures CHASE customers of QUALITY bags on every order.

**IT'S THE PACKAGE THAT GIVES YOU THESE EXTRAS...**

1. Better appearance.
2. Clean, colorful brand printing.
3. More sales appeal.
4. Better protection for your product.
5. A bag designed for your specific problem.
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# THREE MARION 93-M SHOVELS

## Harvest "Rock Cotton" in Canada

Three MARION 93-M Diesel shovels working in asbestos pits of the Canadian Johns-Manville Company, Ltd., in northern Ontario get a real workout.

They are on around-the-clock schedules in land where the mercury can drop to 60 below. The digging is all solid rock.

Two of these diesel shovels load out waste rock on both sides of the fiber-laden serpentine rock which the third machine digs. Despite the rigors of weather and terrain, each MARION turns in impressive tonnage records.

The details about 93-M strength, power and stamina to handle big assignments may point the way to a happy solution of some excavating problem for you. Why not ask your nearest MARION representative today about 93-M Diesel and Ward-Leonard electric machines?

**MARION POWER SHOVEL CO.**
**MARION, OHIO, U. S. A.**

from 3/4 cu. yd. to 45 cu. yds.

OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES

NOW!

# NEW 1954 CHEVROLET TRUCKS

## Completely new—the most powerful, finest performing, best-looking Advance-Design trucks ever built!

Here's America's greatest truck builder's latest and greatest truck! Here's the brand-new line of Chevrolet Advance-Design trucks for 1954!

You'll find they're packed with great new features . . . loaded with big new advantages that mean faster, more efficient service and lower operating costs on *your* job.

**NEW POWER AND ECONOMY**

You get new high-compression power and greater operating economy with *three* advanced valve-in-head engines. Bigger, brawnier "Thriftmaster 235" engine. Rugged, durable "Loadmaster 235" engine. Mighty, all-new "Jobmaster 261" engine*—most powerful in Chevrolet truck history.

**Most trustworthy trucks on any job!**

CHEVROLET

**ADVANCE-DESIGN TRUCKS**

**NEW RUGGEDNESS AND RELIABILITY**

Heavier axle shafts on 2-ton models. Bigger, more durable clutches on light- and heavy-duty models. Stronger, more rigid frames on *all* models. New pickup and stake bodies are built to stand the roughest going and to keep coming back for more—and they give you greater load space for '54!

**NEW COMFORT AND CONVENIENCE**

New Comfortmaster cab provides increased visibility with new one-piece curved windshield. New Ride Control Seat* brings you extra driver comfort. New truck Hydra-Matic transmission* offers the last word in no-shift driving ease. Available not only on ½- and ¾-ton Chevrolet trucks, but on 1-ton models, too!

Plan to see the completely new '54 Chevrolet trucks, and get the whole money-saving story at your Chevrolet dealer's now. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

**Optional at extra cost. Ride Control Seat is standard on C.O.E. models, available on all other cab models as extra equipment. Rear corner windows in standard cab, optional at extra cost.*

**MORE CHEVROLET TRUCKS IN USE THAN ANY OTHER MAKE**

Ripl-Flo SCREEN with Tri-Slope DECK

# SCREENS

## Moist Fine Material

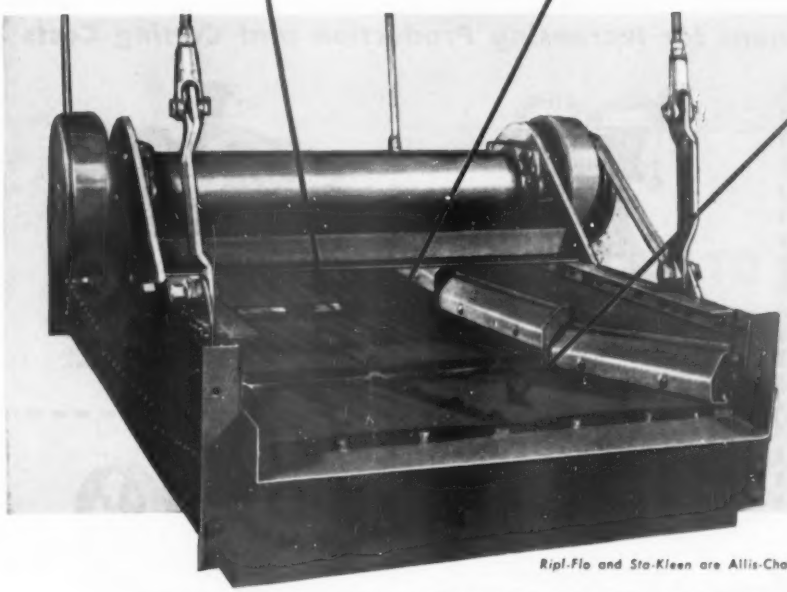
**No excessive blinding** and no shutdowns to clear the screen! With the "Tri-Slope" deck you can screen moist ½ x 0 to ¼ x 0 granular materials having high surface moisture. And you'll get more capacity than with a single slope deck of the same area.

Each deck section has a slope of 5 degrees less than the preceding section, resulting in a controlled rate of travel over each section.

*Moist, fine material passes rapidly over the feed end section to reduce the depth of the bed.*

*It is then retarded on the intermediate deck to maintain proper bed depth.*

*It is slowed down still more on the discharge end section to pass marginal size particles.*



**Each section** of the "Tri-Slope" deck is designed for rapid stratification of the bed, resulting in high capacity. Moist, clogging particles are dislodged by the *Sta-Kleen* feature, consisting of bouncing rubber balls between the screen cloth and a ball retaining deck. The A-C representative in your area will gladly give you more details. Call him, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3995

Ripl-Flo and Sta-Kleen are Allis-Chalmers trademarks.

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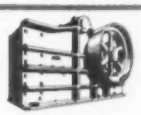
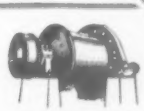


Jaw Crushers

Gyratory Crushers



Grinding Mills

Kilns, Coolers, Dryers

# *Increase Your Output up to 300%...*

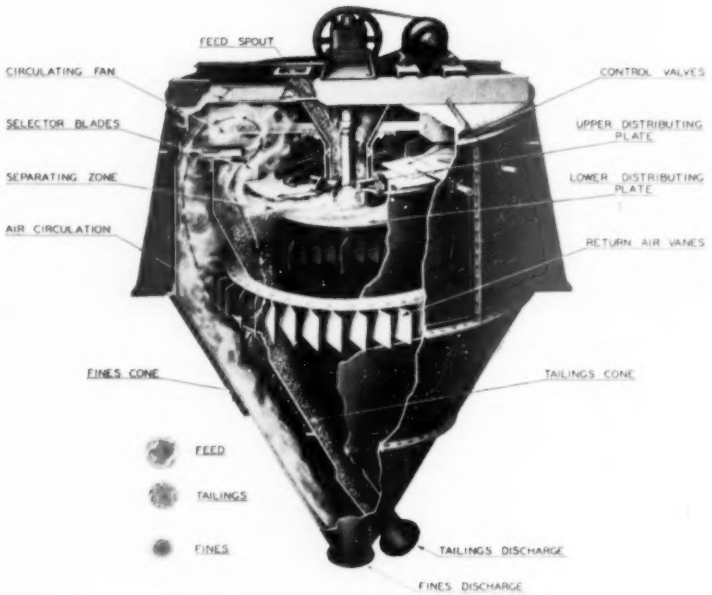
## Get Accurate Fines with...

# STURTEVANT

## *Whirlwind Centrifugal* SEPARATORS

The Sturtevant Air Separator is one investment that pays off daily profits by increasing production and reducing costs. Its extremely efficient operation assures finer separation of fine material from coarse material with the result that uniform quality of product is always obtained.

They'll not only increase your output by as much as 300%, but provide 10 to 50% savings in power costs, too. They are available in sizes 3 to 16 feet in diameter with capacities from ¼ to 50 tons per hour with a fine-product range of 40 to 325 mesh or finer. Bulletin 087 gives the entire story. Write for your copy.




### *Other Sturtevant Equipment for Increasing Production and Cutting Costs*

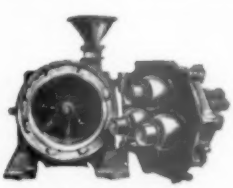
**MICRONIZER® GRINDING MACHINE**

A fluid jet grinding machine, the Sturtevant Micronizer speeds reduction of materials to low micron sizes. These jet mills are especially applicable in fields where a particle size in microns is desired.

Sturtevant Micronizer grinding machines are available in many sizes and capacities.

**ROTARY FINE CRUSHERS**

for intermediate and fine reduction (1" to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.

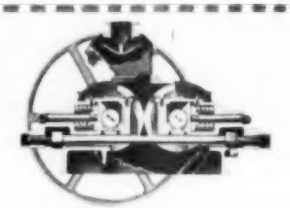


**RING-ROLL MILLS**

for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operate in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.

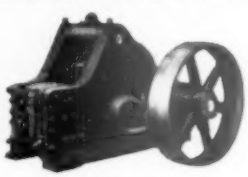
**SWING-SLEDGE MILLS**

for coarse and medium reduction (1" to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.



**CRUSHING ROLLS**

for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8x5 to 38x20. The standard for abrasives.



**JAW CRUSHERS**

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GM DIESEL
CASE HISTORY No. IC9-85

**OWNER:** Rose Construction Co., Atlanta, Georgia

**INSTALLATION:** GM 2-71 Diesel, replacing a gasoline engine in ½-yd. backhoe.

**PERFORMANCE:** Shovel now works faster, maintains the load and doesn't stall. Previous engine was burning 35 gallons of gasoline in 8-hour day; GM Diesel uses only 6 to 8 gallons of Diesel fuel per day.

*It pays to STANDARDIZE on*

GM
GENERAL MOTORS
DIESEL POWER

# SWITCH FROM GASOLINE TO GM DIESEL SLASHES FUEL COST

You can see from the above that it won't take long for this General Motors Diesel to pay for itself out of fuel savings alone. Add the extra work it does every day—the lower cost of maintenance—increased equipment availability—longer engine life—and you'll see why buying a GM Diesel is one of the best investments you can make.

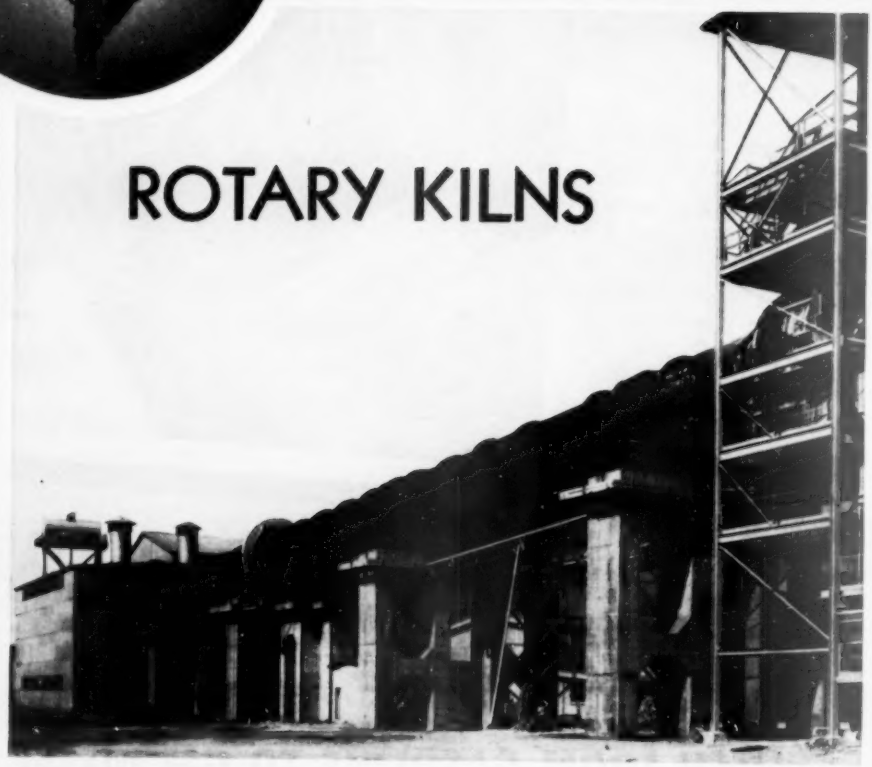
The GM Diesel starts at the push of a button—uses fuel in direct proportion to the work it does. It gets work done faster because with 2-cycle operation it accelerates faster under load changes. And because of its smaller size, it often fits where other Diesels won't.

If you have equipment that needs new life, contact your GM Diesel distributor. He will analyze your power requirements and show you in dollars and cents how much this engine can save for you. No obligation, of course.

**DETROIT DIESEL ENGINE DIVISION**
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 16 to 275 H.P. Multiple Units . . . Up to 840 H.P.

# SMIDTH

## ROTARY KILNS



Smidth machinery has been supplied to over 70 countries of the world including 1,100 rotary kilns and 5000 grinding mills, plus auxiliary machines such as coolers, agitators, washmills, pumps, conveyors, packers, separators, etc. for use in Cement, Lime and Ore plants.

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# "WE HEAR..."

December, 1953

The Construction Cost Index for November was 610.92 (based on 1913=100), an 0.3 percent increase over the October index, as reported by Engineering News-Record. The Building Cost Index for November (also a 1913 base) was 436.34, which was approximately the same as reported for October. Both the Construction and Building Cost Indexes are close to their respective all-time highs reached in August, 1953, but they have climbed much slower through 1953 than 1952. In the 12 months ended November, 1953, the Construction Cost Index climbed by 3.8 percent, compared to the 7.6 percent increase during the previous 12 months. The Building Cost Index, during the 12 months ended in November, 1953, climbed by 2.4 percent, compared to 5.3 percent for the previous 12 months.

* * * * * * * * * *

The United States government has been awarded $3790 in damages by the Construction Materials Co. of Arizona and a Nevada general contracting firm, following a ruling late in March by the U.S. district court judge. The government charged the firms "unlawfully took and used gravel, sand and other materials from a pueblo that was under guardianship of the government." Although the government sought $148,838 for the value of the materials, restitution of interest charges, and recovery costs, only the sum representing value of the materials in place on the pueblo lands before processing was assessed. The company claimed that a sales agreement had been made with the pueblo, but the contracts were ruled invalid because they had not been approved by the Secretary of the Interior.

* * * * * * * * * *

During the first nine months of 1953, railroads installed 1683 new locomotive units, of which 1667 were diesel-electric, 12 were steam units and four were gas turbine-electric, as recently reported by Missouri Pacific Lines. New locomotive units, on order October 1, included 520 diesel-electric units, three steam, ten electric and 15 gas turbine-electric.

* * * * * * * * * *

A novel technique using inexpensive precast concrete arches to span 50-ft. warehouses has been developed by C. Lyman Ellis & Co. of Harlington, Texas, as recently reported in Architectural Forum. Costing only $1.40 per sq. ft., the arches are joined together with crossed tie rods of 1-in. steel to reinforce the roof. The new system should prove useful for single-story buildings requiring durable fireproof roofs. Such spans reportedly can be made up to 100 ft. in width.

* * * * * * * * * *

Heavy construction awards, nationally, totaled $13,018,447,000 for the first 45 weeks of 1953, as reported by Engineering News-Record. This was a decrease of 6 percent from the record $13,897,831,000 awards reported for the corresponding 1952 period, but still the second highest year on record, in dollar value of heavy construction awards.

* * * * * * * * * *

One drought-striken area in the United States which hasn't had to call upon the government for emergency relief measures, is the little community of Melvin, Ohio, which owes its thanks to the local Melvin Stone Co. The company has been supplying water to the farmers for their livestock and for other uses (except drinking purposes). The water is pumped from the quarry to a tank on top of one of the buildings at the quarry, where farmers may come to fill their tanks, free of charge.

* * * * * * * * * *

Another dynamite theft has been reported—this time by a Joplin, Mo., gravel company. The theft was said to have included three or four boxes of 2 x 16 dynamite charges, 500 ft. of dynamite cap, 45 electric caps, 500 ft. of white wire, an undetermined number of orange fuses, and a pair of fuse clippers.

## WE HEAR

According to a recent report in Mine & Quarry Engineering, research workers at Bell Telephone Laboratories have found a way to grow single crystals of quartz weighing more than a pound in 60 days. The technique employed is a temperature-difference hydrothermal method using a quartz nutrient in silver-lined steel autoclaves up to 4 ft. long and 4 in. in internal diameter, and weighing up to a half a ton. Pressures of 1000 atmospheres are obtained by filling the autoclave to 80 percent of its free space with aqueous alkaline solution and heating to 400 deg. C. A "seed" of crystal quartz is introduced into the autoclave to initiate crystallization. Large single crystals of quartz, free from twinning and suitable for piezo-electric purposes, reportedly have been produced.

* * * * * * * * * *

Plans for a 1400-mile expressway from Chicago to Miami, to cost an estimated $1,500,000,000, were recently made public through a joint announcement by the five states involved. The governors of the five states—Indiana, Kentucky, Tennessee, Georgia and Florida—have appointed a two-man commission to conduct a survey of the proposed project. If the survey concludes the project to be feasible, the states will coordinate their construction programs so that all of the work will be opened to traffic at about the same time. Each state would finance the mileage within its own borders in any way it sees fit. Three of the states, Indiana, Kentucky and Florida, have toll-road commissions.

* * * * * * * * * *

A new self-unloading vessel of unique design, to be used for shipping bauxite, has been added to the fleet of Saqueney Terminals, Ltd., the transportation branch of Aluminum Co. of Canada. The 7859-ton vessel, built in Burntisland, Scotland, reportedly incorporates many revolutionary innovations. The vessel has been fitted with a continuous central compartment, in which bulldozers reportedly will quickly attain maximum loading capacity. Hitherto, self-unloading ships handling bulk cargoes have had belt conveyors in tunnels the length of the hull to carry the material to elevators, usually in the bow. Some use drag scrapers for the same purpose. A self-unloading ship equipped with bulldozers would be a novelty in the bulk-cargo shipping field.

* * * * * * * * * *

Approximately 50,000,000 tons of iron ore are expected to be uncovered at Inland Steel Co.'s $25,000,000 dredging operations at Steep Rock Lake near Atikokan, Ont. The lake is said to have an estimated deposit of from 200,000,000 to 500,000,000 tons of iron ore beneath a layer of fine silt several hundred feet thick which forms the lake bottom. An underground mine, 50 to 400 ft. deep, will be sunk into the ore body, enabling an estimated 3,000,000 tons of ore to be mined annually.

* * * * * * * * * *

According to a National Highway Users Conference analysis, recently released by the Bureau of Public Roads, a substantial reduction has been effected in the total amount of highway tax revenues diverted by the states to non-highway purposes in 1952. A total of $202,800,000 of the highway income was spent on non-highway purposes in 25 states and the District of Columbia, amounting to about 24 percent less than the amount diverted in 1951.

* * * * * * * * * *

A Rochester, N.Y., truck driver recently ran into a bit of difficulty in his daily concrete delivery job. In delivering a load of ready-mixed concrete, he backed the 48,000-lb. loaded truck into the driveway of a house under construction and sank into a 5-ft. mud hole which had been dug to install a water pipe to the house. When the truck was towed out five hours later, the concrete had hardened.

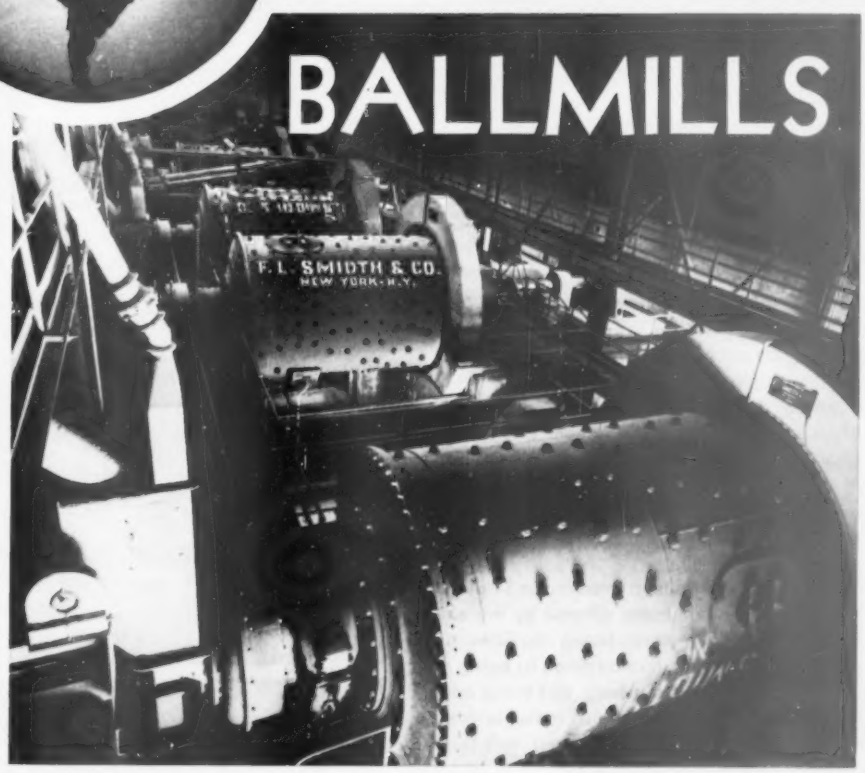
* * * * * * * * * *

Installation of a "push button" system of blowing concrete by compressed air through a pipe from an underground mixing station into construction forms was recently reported by International Nickel Co. of Canada, which has installed the system at its Creighton mine. When the concrete is mixed, it is blown through a line of 6-in. steel pipe which reportedly carries it along levels, up or down manways, and through twists and turns of the mine's workings until it drops into forms at the construction site. The system is said to be speeding the company's program of mining by induced caving. The company is stabilizing areas of the mine worked and abandoned several years ago.

THE EDITORS

# SMIDTH

## BALLMILLS

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# PROFITABLE PLANTS DON'T JUST HAPPEN!

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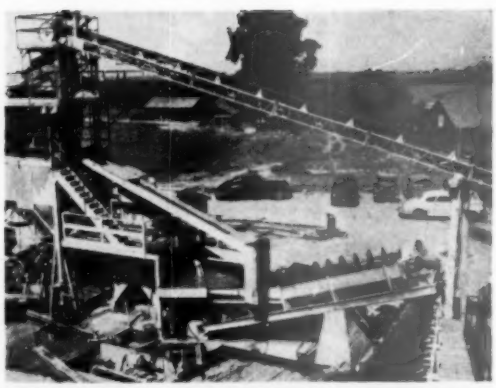
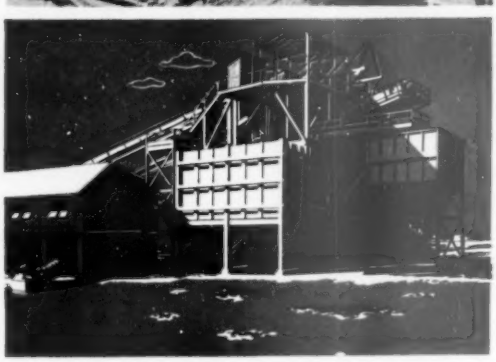
Better specification sand and gravel at lower cost . . . that's what you get with a WKE designed aggregate plant. And it's not just a matter of luck. For WKE plants are the result of long experience and integrated planning of the job from start to finish. Aggregate analysis, plant design, procurement and installation of equipment and initial plant operation — for any or all of these functions you can rely on Western Knapp Engineering Company, a division of Western Machinery Company.

Coupled with WKE's specialized knowledge in plant design, you gain the advantages offered by the extensive purchasing and manufacturing facilities of Western Machinery Company. In addition to being a leading supplier of crushing, washing, screening and material handling plants, Wemco also manufactures a line of aggregate processing equipment including Sand Preparation Machines, Attrition Machines, Sand Pumps, Hydroseparators and Thickeners. This close coordination between plant design and equipment procurement and manufacturing assures profitable sand and gravel operations with facilities that are custom-built according to your exact requirements.





**If you're planning new plant construction or the expansion of present facilities, why take a chance. Put the WKE/WEMCO team to work on your problem and get the job done right! *Write today for additional information.***

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# Outstanding performance is Standard performance

## with B&W Feed Pipes . . .

## Tail-Ring Castings

In cement kilns throughout the industry, long-lived B&W alloy Tail-Ring Castings and Feed Pipes have established a firm reputation for outstanding performance and economy by reducing operating costs and contributing to sustained high production.

B&W Tail-Ring Castings withstand temperatures exceeding 1800 F at the feed end of the kiln; standard kiln lining only is needed. These castings provide a kiln opening of proper size, and are designed with overlapping segments, which prevent loss of feed material and allow ample expansion to minimize the possibility of belling out of the kiln shell.

Because greater resistance to heat and wear is "built in" at the foundry, B&W cast alloy Feed Pipes consistently outlast conventional types by wide margins under the most rigorous service conditions. A typical design, illustrated, incorporates a special clamp, located according to specific service conditions, and permitting renewal of *only* the lower portion of pipe after years of punishing service . . . a further cost-saving feature.

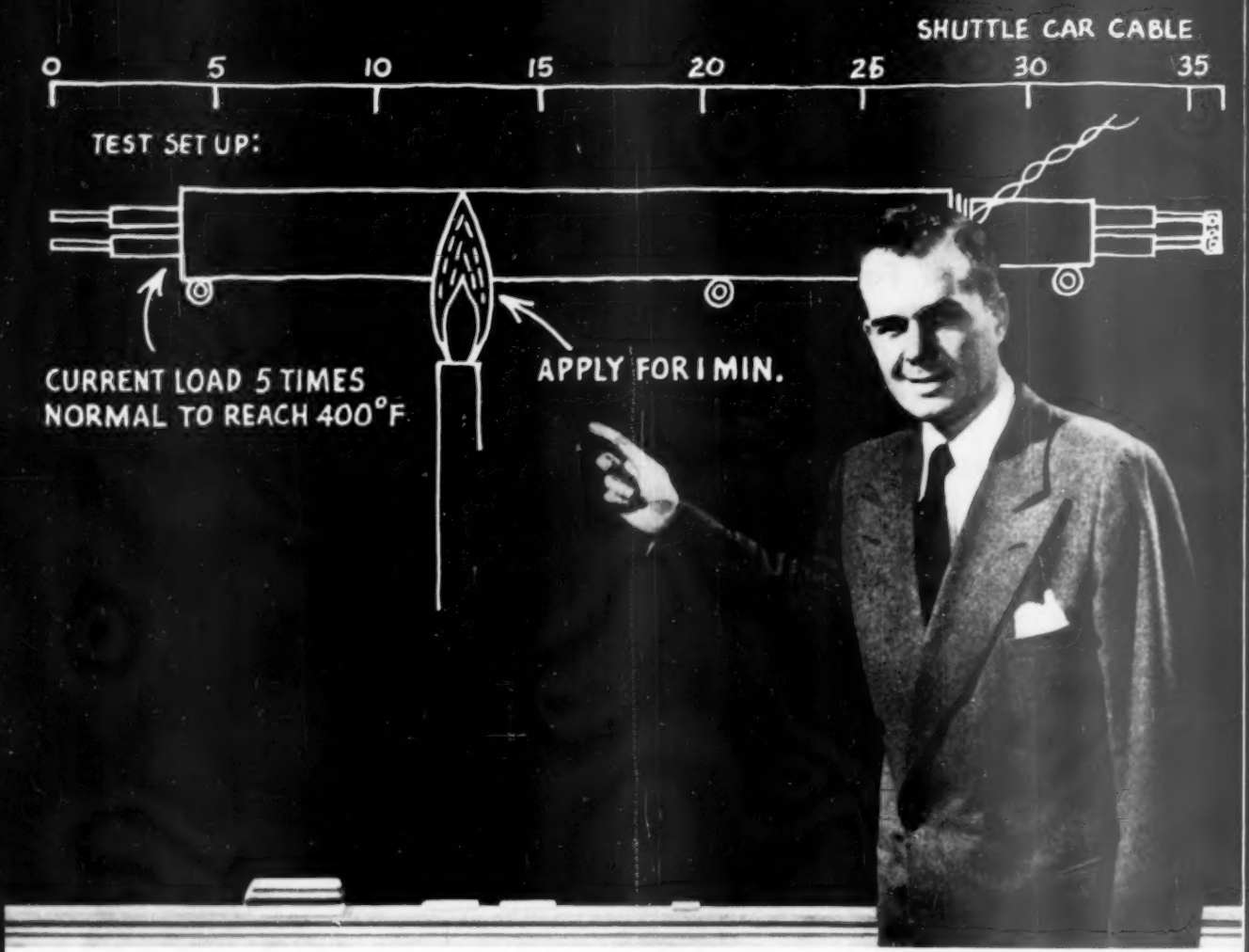
Feed end of kiln, with B&W Feed Pipe

Application of Tail-Ring Castings

For detailed information in relation to your requirements write: The Babcock & Wilcox Company, Process Equipment Dept., Barberton, Ohio.

BABCOCK & WILCOX

S-424




**APPROVED USBM TEST:** Cable fails if it burns more than 6 inches or flames more than 3 minutes.

# NO ANACONDA CABLE EVER FAILED THIS TEST

The U.S. Bureau of Mines flame-test for trailing cables is tough. But ANACONDA Cables have passed every time... *with ease*. That's not all! Performance-wise, a recent survey of shuttle cars in 15 mines found ANACONDA Cables last up to 300% longer than cables used only a few years ago.

**NEW FEATURES GIVE CABLE STAMINA**

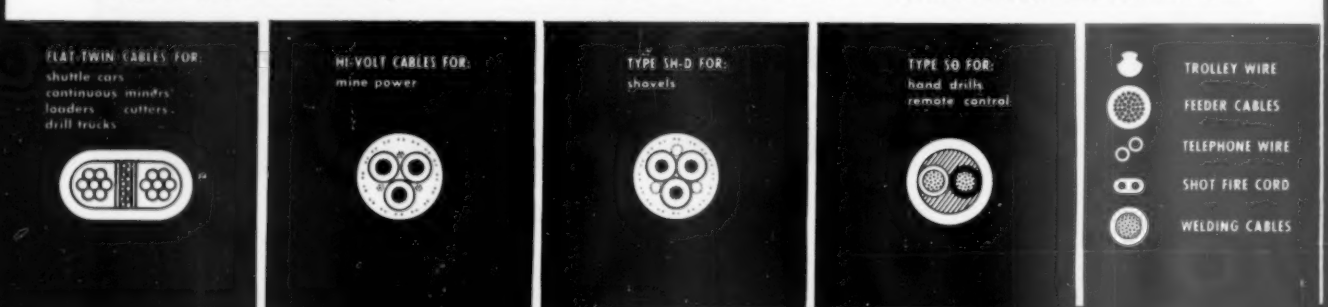
These facts are as good a certificate of quality as any we know. As new features have been added to ANACONDA Shuttle Car Cables, each has been repeatedly tested on special, scientifically designed equipment. A new improved neoprene jacket is tougher, more flame-resistant. You'll find more strength and heat-resistance in the new cold-rubber insulation. The cable has also been stranded in a new and decidedly better way. No wonder it can take more abuse from overloads, compression-cutting, sliver-cuts in wet mines, rib-pinching, runovers and dragging. Patented breaker strip* and balanced tensile strength of ground and power conductors make it safer to use.

**A CLOSE LOOK AT CABLE COSTS**

Examine this cable yourself. Ask your Anaconda Sales Office or Distributor for a sample. Test it . . . tear it apart. Then look at the cost of *one* shutdown on any working face of your mine caused by *one* break in cheap cable. It far exceeds any possible saving from buying cable on price. Your own production figures soon prove the value of quality cable. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.* *U. S. Patent No. 2,455,773 5390

**ANACONDA®**

**TODAY'S HEADQUARTERS FOR MINE CABLE**



# Editor's page

## A Source of Ideas on Building Good Community Relations

WE HAVE JUST READ a handsome booklet, "GM Lives Here," published by General Motors' Department of Public Relations, that is a wonderful handbook on the subject of building good community relations. It is an easily-read book of suggestions, each of which represents an actual successful experience of one of General Motors' plants in its approach to fulfilling its civic responsibilities.

It is a remarkable work in the way that it deals with abstract problems and brings out specific procedures for their solution. The need for workable ideas of the kind brought out in the booklet was never greater and it is recommended reading for every employer.

Many producers in the rock products industries had better become interested in this subject, for there never has been a time when they have been subjected to so many pressures, which can only be interpreted to mean that they are not accepted as good neighbors. These pressures comprise zoning restrictions, and complaints about noise, unsafe conditions, dust, dirt, vibration, traffic hazards and most everything else that could be criticized. They constitute threats to continued operations and must be faced.

### Zoning

The booklet has many thoughts on how to soften and forestall such pressures; and, it has useful suggestions on how to approach the very vexing problem of having zoning ordinances written that will objectively consider the side of the plant operator. That is a very serious threat, particularly where aggregates plants are contiguous to metropolitan areas, and it is one that is becoming worse as population centers encroach upon their deposits.

Where General Motors has been confronted with zoning restrictions which oppose establishment of a plant, the proposed layout of the plant is made public and emphasis is given to the provisions for landscaping, parking facilities and other desirable features. Various means are used to bring out how the contemplated plant will increase the community's purchasing power, benefit local merchants and, through taxes, help pay for schools and other civic needs.

Slide films are one method used to show the layout of proposed plants. A large eastern sand and gravel producer recently used a scale model of its plant and surrounding terrain to demonstrate exactly what it intends to do with respect to after-treatment and rehabilitation of the worked-out property. A midwestern sand and gravel producer pays a cent a ton of production into the city treasury, ear-marked for future land rehabilitation.

The problem of building better community relations, generally, is pointed up nicely in the introduction to the GM booklet by vice-president Paul Garrett, who wrote:

"Many years ago it was recognized in General Motors that good relations outside grow from good relations inside. What people think of us within our own organization, and in communities where we operate plants, molds the opinion of General Motors by people over the nation.

"It has been the stated policy of General Motors to encourage local management to conduct its daily operations so as to earn for General Motors the reputation of being a good place to work and a good organization in the community."

### Gaining Acceptance

This philosophy applies just as well to smaller companies for they, too, are subject to the forces of rumor, idle gossip, misinterpretation and misinformation that undermine good community relations. The booklet gives examples of how plant management has been successful in meeting such situations by setting the record straight in advance and using the local press to help.

However, it goes deeper than that and explains how plant management must first go about earning the respect and confidence of people in the community through leadership and active participation in community affairs. A genuine interest in the life of the community must be the motivating force behind it all, and this is emphasized.

The value of good relations with the local newspapers is stressed, as the best means of keeping the community informed of what the plant is doing, why, and its plans for the future. We feel that the rock products industries are not capitalizing on this medium. When a plant is undergoing expansion, or building, its scope, services and effects on payrolls and taxes should be publicized.

Good community relations, GM emphasizes, must recognize that people are its most important asset. Without people there would be no business and therefore they must be given every consideration so that there will be a supply of good will built up from which to draw in emergency.

The booklet deserves reading for it charts a course of action.

Bror Nordberg

# 3 Eagle Screw Washer-Classifier Dehydrators Process "Made Sand" for Arkansas Limestone Co.

**BATESVILLE, ARK.**

SAND made from crushed rock definitely demands classification to insure the correct ratio of gradations so that the ready-for-market product will meet specifications.

The Myersville plant of Arkansas Limestone Co., Batesville, Ark., uses three Eagle Screw units to process sand made from crushed limestone.

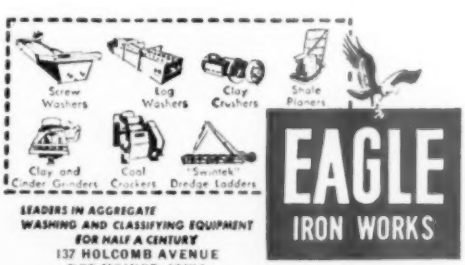
An Eagle 24" x 25' long weir double screw unit provides one gradation of clean sand, an identical unit next to the first provides another gradation and an Eagle 24" x 18' coarse material double screw unit provides the third, and coarsest gradation of washed material.

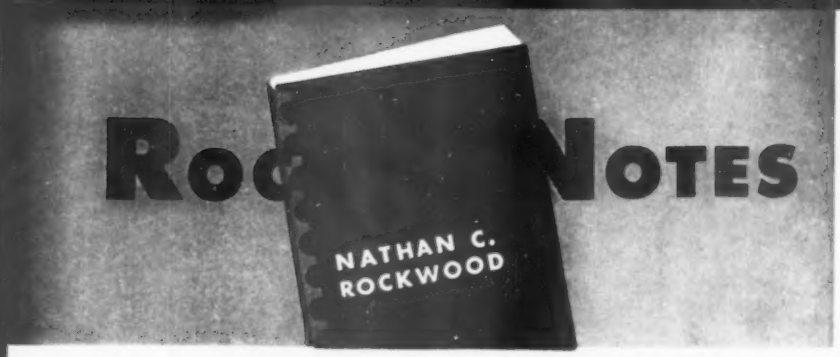
All three units discharge onto a conveyor belt, which also receives limestone crushed to required size—a steady flow of clean, specification aggregate to the stockpile. Output averages 1600 tons daily.

The ability to modify screw speed as required and provision for adjusting the long weir on Eagle fine material washers—to retain or flow-off fines as needed—affords a flexible method for classifying hard-to-grade sands. The flared tub assures ample settling pool — the long drainboard provides for removal of excess moisture. Coarse material unit readily cleans this gradation.

Lean on Eagle's broad experience and thousands of installations to solve your problems.

Write for Catalog 47.






## The Philosophy of A.F. of L.'s President

MAYBE WE DID the president of the American Federation of Labor an injustice by inferring in our Notes page of the November issue that George Meany had given little evidence of labor statesmanship. We were referring, however, only to his reported remarks to an audience of leaders of the A.F. of L. An exclusive interview with him by the editors of *U.S. News & World Report*, published in their November 6 issue, shows that he has at least a few sound ideas about a labor union's place in our economic picture. Probably many of our readers have already perused the contents of this interview in the original. It is in the form of pertinent questions by the editors, and what appears to be extemporaneous answers by Mr. Meany; but presumably he read and approved the copy before its publication. In what follows we will attempt something of a digest of his remarks with our own interpretations and comments.

### Not a Political Group!

Mr. Meany wanted it understood that the A.F. of L. still adheres to the policy established by its founder, Samuel Gompers, of bipartisanship in politics. It will throw its weight, so far as it can, in favor of candidates of either major party who are *friendly* to labor. That means, naturally, although he did not put it in so many words, those who do the bidding of union labor leaders (or, in our language, union bosses). However, he fully recognizes that with the secret ballot system established in our country, the A.F. of L. and no labor organization can control votes, or deliver an election, or make any claim that it can. Mr. Meany infers that the C.I.O. is a different kind of a labor union. He said: "Of course, the C.I.O. was not really formed to carry the ball for industrial unions. It was set up because there were several men in this country who felt they needed a political arm among the workers of the nation." Probably most of us long ago realized why F.D.R. and his managers promoted the C.I.O. for their own purposes, but here is a frank admission by a union chief.

The A.F. of L. depends for its political strength or influence on its Labor's League for Political Education. This is designed, primarily, according to Mr. Meany, to get out the vote, and of course to influence that vote, so far as possible. Mr. Meany says the League is now so well organized that it can work on the precinct level. As proof that its methods are effective, he referred to the recent Democratic victory in the special congressional election in Wisconsin, where the League worked to get out the vote of union labor and the farmers, while the reputed Republicans, while a majority, did not take enough interest in the election to vote at all. Although Mr. Meany, naturally, did not say so, this kind of thing is one of the greatest threats to conservative and honest government that we face today. No one can quarrel with his purpose to get out the vote, every organization claiming to accomplish any civic service should do as much, but the so-called educational matter put into the hands of the voters by the League must of necessity be one-sided propaganda; and to balance the scales some way must be developed to combat it with more of an unbiased picture.

### Labor Legislation

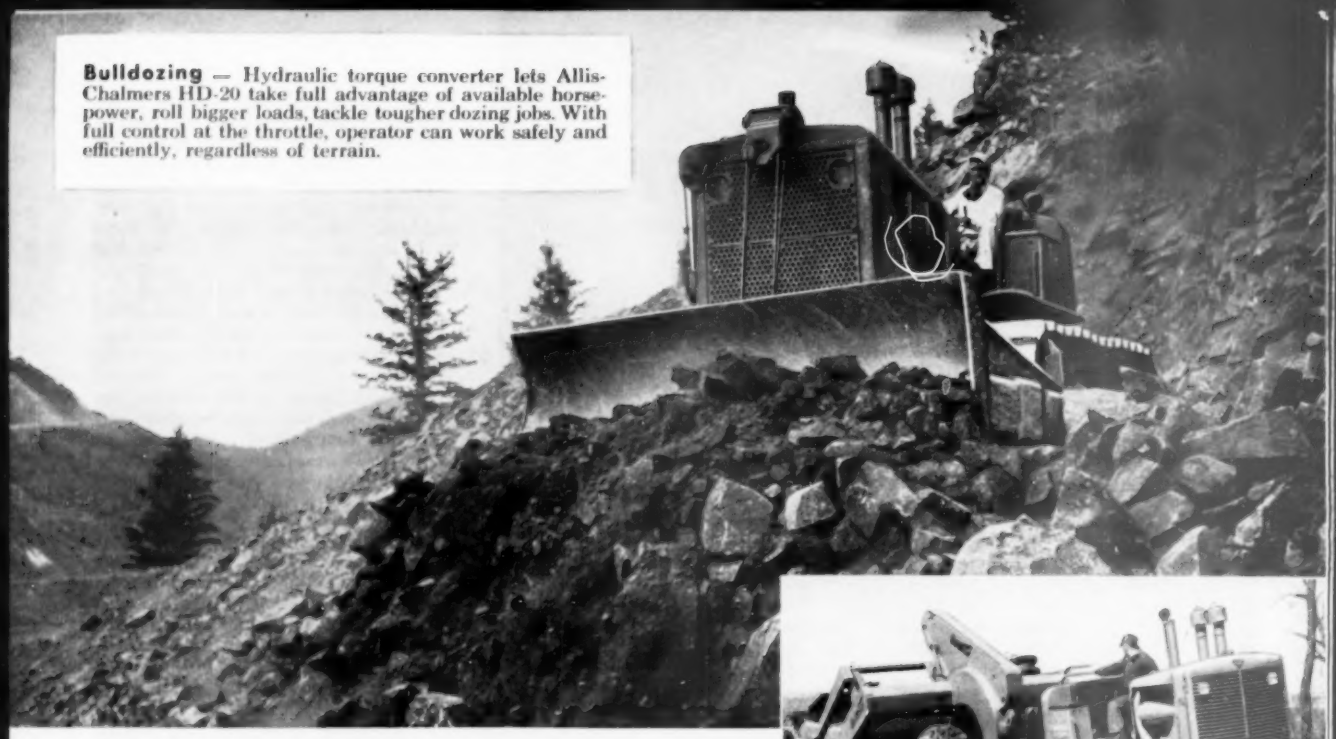
On the subject of prospective labor legislation, Mr. Meany shows himself much more of an exclusive advocate of labor's wants or demands than as a patriot or statesman who believes that labor can prosper only while the country as a whole prospers. He would continue demands for higher and higher wages, and more and more fringe benefits and hold management responsible for making good. While he appreciates that our economic system depends on a profit motive, he holds that the making of a profit is the problem of the individual plant management; he said: "We want management to manage. If management doesn't manage the way it should so that we can get a decent wage out of the business venture, then, of course, we are going to fight for a decent wage anyhow. . . . However, we don't want to interfere with management."

Mr. Meany—and other labor union leaders—were not satisfied that the proposed 19-point revision of the Taft-Hartley Act, inadvertently released by the White House some months back, went far enough. It is evident from all his remarks that nothing will satisfy him and other labor union bosses but a return to the Wagner Act, or something like it, which will offer no obstacles whatsoever to forcing union membership on every so-called industrial worker. Mr. Meany freely admitted that the Taft-Hartley Act had slowed down the previous rate of increase in membership; and he insisted that under the Act any employer who was willing to fight hard enough could keep unions out of his business. While he obviously did not mean it that way, this seems a confession that union membership can't grow as it did under what was practically government coercion of the Wagner Act, if the worker himself is left any choice in the matter. Mr. Meany blames the employer, but obviously the real culprit is the independent American citizen who wants *no one* to tell him where to get off.

### Protective Tariffs

Most intelligent people who attempt to follow the policies established or in the process of being established, by our federal government, can see the inconsistency of providing Europe and other parts of the world with capital taken from the incomes of American taxpayers (largely directly and indirectly from our own industry) so that these countries can regain their economic feet. Presumably, this is done so that they can produce, and so that trade can then take the place of alms. Hence, to be consistent we must let down our tariff barriers and trade with them; if we don't, obviously, we have practically thrown away the billions of dollars given to them. But to accept imports, which other countries can send us, that can be sold at a profit to them, but at a lower price than the homemade competing article, tends to create economic disturbances here. The only logical way to meet such disturbances is to work toward lowering the cost of our homemade product. Since with the up-to-date equipment and know-how we have provided these foreign competitors it can be only the lower wage level abroad that creates the difference in cost (and price), the issue logically boils down to a levelling of wage rates here and abroad. When such a thing is merely mentioned a "patriotic" howl goes up.

Nevertheless, Mr. Meany asserts that the A.F. of L. is "much closer to the free-trade policy than to the high protective tariff." This apparent anomaly is accounted for by what followed, since he admitted that there is, or was, such an organization as the Wage Earners' Protective League, composed of interested A.F. of L. unions, which does lobbying for protective tariffs. Portland cement manufacturers, at least, will probably soon become acquainted with this organization, for there is little question that as soon as rehabilitation of war-wrecked Europe is somewhere near completed, much European cement will seek markets in this country. Up to this time the demand has been so great on domestic manufacturers that such cement as has been imported was not much of a market factor.



**Bulldozing** — Hydraulic torque converter lets Allis-Chalmers HD-20 take full advantage of available horsepower, roll bigger loads, tackle tougher dozing jobs. With full control at the throttle, operator can work safely and efficiently, regardless of terrain.

**AN ALLIS-CHALMERS REPORT**

# How hydraulic torque converter drive improves big tractor performance—increases job output

With a two-range transmission and hydraulic torque converter, the Allis-Chalmers HD-20 is the only crawler tractor that is capable of exerting maximum drawbar pull *at all times* . . . under all load and terrain conditions . . . without gear-shift guesswork.

Whatever the job, the operator need merely make contact with the load and then open the throttle. As the load requirements change, the hydraulic torque converter *automatically* matches the conditions with exactly the right combination of speed and pull.

This eliminates most shifting . . . leads to far more work done in a continuous work cycle . . . far longer equipment life.

• • •

*Hydraulic torque converter drive, exclusive as standard equipment with Allis-Chalmers, is just one of many reasons why the HD-20 assures you higher output with less upkeep. Your nearby Allis-Chalmers dealer invites you to get the full story . . . and to see it in action.*

WEIGHT — 41,000 LB. • 175 NET HP. AT FLYWHEEL

**ALLIS-CHALMERS**
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

**Pulling** — Hydraulic torque converter drive actually multiplies torque up to four and one-half times . . . develops tremendous drawbar pull to start the load smoothly . . . and automatically accelerates to the highest speed that conditions permit, in either high or low range.

**Pushing** — Operator just makes contact, then opens the throttle and relaxes. The HD-20 automatically matches speed to that of pushed equipment, maintains steady contact while loading, sends load off to the fill at higher speed.

**Digging and Loading** — With the HD-20G, the operator crowds surely and steadily, using only throttle and bucket levers. With full horsepower always available even at creeping speed, he can work effectively in mud, on hillsides or edges of banks.

# LABOR RELATIONS TRENDS

## Right to Fire for Cause Upheld and Another Decision of General Interest

By NATHAN C. ROCKWOOD

IT SEEMS TO US that one of the biggest mistakes labor unions can make is to take up the cause of proved incompetent workers. For if our economic system, indeed our very nation, is to endure, obviously it is only by efficiency of production. The chief economic flaw in any communistic system is that work and industry soon degenerate to the pace set by the least efficient, least ambitious and least industrious worker—for human nature prevents one from wanting to be "the goat" to do another's job, that he may live in comparative idleness. The very origin of communism was belief that "workers" slaved to support the idle rich. The Russian bureaucrats, while no longer communists, found out that fact early and were driven to despotism to compel labor to produce by imposition of harsh penalties for failures.

One of the worst things that can happen to American industry from a labor point of view is any infringement of the right of management to require honest work in answer for a honest wage. So far, the arbitrators in dispute settlements appear to recognize this fact, although under the influence of a pro-labor National Labor Relations Board in the past 20 years, it has sometimes seemed that their decisions leaned toward the labor-union side. All such decisions as occur in our own industries are interesting and instructive in guiding operators in similar cases as may occur at any time in their own plants. What follows are extracts from the decision of the arbitrators called in to settle a dispute arising from the discharge of a kiln-burner at one of the plants of the Ideal Cement Co. In this case the two arbitrators representing the company and the disinterested point of view, respectively, constituted the majority in the decision with the union-appointed arbitrator dissenting (as usual).

### Factual Background

In the words of the decision: "The grievance at issue is: Did the company have the right to discharge employe?"

"The essential facts are undisputed. The employe entered the employ of the company on or about September 8, 1948, and advanced through several job grades from yard laborer to kiln-burner. On July 1, 1953, he had about 18 months' experience as a kiln-burner and was working the second shift in this capacity. A kiln-burner in a cement works is responsible for processing or 'cooking' raw materials (slurry) in a kiln to produce a clinker from which cement is made; he is in complete charge and is responsible for the operation of a kiln and its auxiliary equipment including fans, coolers, fan dampers, etc. His duties include the control of certain gas valves which regulate the amount of fuel reaching the interior of the kiln, control of certain dampers and fans which, in turn, control the amount of air draft reaching the interior of the kiln. As a further duty, a kiln-burner has the responsibility to, on necessary occasions, 'burn out' or 'run empty' a kiln, i.e., to clean and cool a kiln.

"At the time in question, three employes were at or near the kiln: this man, his shift-helper, and a clinker-belt man, all of whom testified at the hearing.

"To 'burn out' or 'run empty' a kiln is to cool and clean it. The process, reduced to its essentials, requires the kiln feed or 'slurry' to be stopped and water put into the kiln in its place, along with a reduction or elimination of the fuel and the draft of air reaching the interior of the kiln. A damper may be opened or closed to control the air draft or the 'air-gas ratio.' As the damper closes, air (oxygen) is reduced in the kiln. The oxygen supply may also be cut by turning off an exhaust fan which operates in conjunction with the draft opening. Other controls regulate the fuel supply. A properly burned-out kiln cools without damage and contains little, if any, kiln feed.

"Thus three factors control the kiln temperature; the fuel supply, the air draft, and the kiln feed (or water). As the fuel is cut back, as the draft is closed, and as water is injected into the kiln, a temperature drop is obtained inside the kiln. Any one of these factors will lower the kiln temperature; proper manipulation of all three is essential to a safe 'burning out' of a kiln. In an emergency, a kiln may be cooled most rapidly by injecting water, but cutting the fuel entirely out, and by closing the damper completely or switching off the draft fan. This would cool the kiln quickly and effectively, but would not necessarily cool in such a way as to cleanse the kiln of all kiln feed, which is desired. Careful manipulation of all three control factors is essential to a correct burning out of a kiln. If the damper switch control is ineffective, the same result can be obtained by turning off—by a switch—the electric exhaust fan.

"The evidence is clear that the employe commensed to close down the kiln at about 3:15 p.m. by turning off the kiln feed and sending his helper to insert the water hose and put water into the kiln via the feed chute. At the same time, he lowered the fuel supply and partially closed the damper. A drop in kiln temperature was registered, as desired and expected. From 4 p.m., he gradually cut back the fuel supply. Shortly before 5 p.m. he noticed that the temperature gauge was 'jumping' and rising. He subsequently, at about 5 p.m., cut the fuel supply off entirely, and closed the damper to 0.7, which was, according to his testimony, as far as he was able at the time to close it.

"He then checked the water hose and found it lying along the side of the feed chute with the water turned off. He replaced the hose and turned the water on. With no fire in the kiln, the temperature declined shortly thereafter, but then climbed rapidly again. However by the time he replaced the water hose, the temperature at the back end of the kiln's interior had reached approximately 900 deg. or some 200 deg. above the 700 deg. danger point. The chain section inside the kiln, at this time, was white-hot, and promptly melted and became a total loss, as did the supporting segments, with resultant damage of some $6500.

"Immediately after the incident, the plant manager talked with this employe and asked him, 'Have you any excuse to offer to account for the damage done to the chain sections and kiln?' He replied, 'I have no excuse; I do not have to make excuses.' He was sent home, and was informed the next day that he was discharged from the employ of the company.

"Exhibits introduced at the hearing, showed that on June 16, 1953, and again on June 18, 1953, this employe was reprimanded for sleeping on the job, and was informed that, if caught sleeping again, he would be temporarily laid off.

"The two helpers both testified to the above facts, to the extent of their knowledge and observation, as did the accused employe and plant manager.

"The hearing also produced disclosure of the fact that the employe, along with other regularly-employed kiln-burners, had been given some formal instructions on kiln operation. However, he had not participated in one phase of the instruction program, due to his being on vacation or for other reasons. During his 18 months as a kiln-burner with the company, he had burned out a number of kilns, properly and without mishap. The evidence does not justify a finding, there-

(Continued on page 139)

# CRAWLING is often necessary but for SPEED

## there's nothing like rolling on WHEELS!

Under many conditions crawlers are the most practical type of mounting. BUT, very often traction is not much of a problem for shovels, cranes and draglines and you can make terrific savings by using a high speed LIMA PAYMASTER on wheels.

The picture at the right shows a LIMA Type 34-M PAYMASTER crane, equipped with a 35-ft. boom, unloading coal from a barge at an eastern Pennsylvania power plant. Note that it is mounted on an undercarriage with 12 rubber tired wheels.

This LIMA 34-M is a natural for industrial plants . . . it offers fast mobility between widely separated jobs, traveling up to 8.24 MPH on a 2.75% grade and 0.94 MPH on a 22.5% grade with four-speed transmission. Just one man is needed to operate it and a single engine powers the crane motions and propels the carrier. It can lift up to 20 tons and is readily convertible to a dragline.

If you would like to know more about how the LIMA Type 34-M PAYMASTER will pay off with speed and efficiency for your operations, drop a note to—

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# PEOPLE in the news

## Sales Representative

HOWARD E. HARTMAN has been appointed sales representative and service engineer for the Metropolitan Chi-

Howard E. Hartman

cago division of Marquette Cement Manufacturing Co., Chicago, Ill. He was formerly sales-service representative for Lone Star Cement Corp. and more recently engineer for Concrete Joists and Products Co. A graduate of Iowa State College, Ames, Iowa, with a degree in civil engineering, Mr. Hartman is an expert in the uses of cement and concrete.

## Kaiser Appointments

WILLIAM T. BURNS has been appointed assistant general superintendent of the Natividad dolomite and Moss Landing refractory and magnesia plants of Kaiser Aluminum and Chemical Corp., Oakland, Calif. Jack D. Moore has been named superintendent at the Moss Landing magnesia plant; J. Ivan Hall has been made superintendent at the Natividad plant; Clarence A. Rick has been appointed assistant superintendent at the Moss Landing refractory plant, and Arthur W. Vettel has been named assistant superintendent at the Moss Landing magnesia plant.

Mr. Burns, who will assist D. M. Kerr, general superintendent of the chemical division's California plants, joined the company in 1941 as a junior engineer at the Permanente, Calif., magnesium plant, later becoming operations superintendent. A graduate of the University of Alaska, Mr. Burns also served the company as senior research chemist at the Baton Rouge, La., refining plant and hot line supervisor at the Trentwood, Wash., rolling mills. Prior to his recent appointment, he was superintendent at the Moss Landing magnesia plant.

Mr. Moore, formerly superintendent of the Natividad plant, became associated with the company in 1942 as a junior engineer at the Permanente magnesium plant. He has also been senior engineer for the Salinas area plants and assistant to the works manager of the chemical division plants. He is a graduate of the University of Arizona where he received his B.S. degree in mining engineering and took postgraduate work in metallurgy.

Mr. Hall has been with the company since 1942, starting at the Permanente magnesium plant, becoming chief chemist and assistant superintendent at the Natividad plant. He received his B.A. in chemistry at the University of Oregon.

Mr. Rick, formerly assistant superintendent at the Moss Landing magnesia plant, has been with the com-

William T. Burns

pany since 1946, beginning as a ceramic engineer at the Milpitas, Calif., research laboratory.

Mr. Vettel, who joined the company in 1941, was formerly supervisor in the research department at the Moss Landing magnesia plant.

## Mechanical Engineer

GEORGE F. WIESE, former superintendent of the Lone Star Cement Co., Calaveras Cement Co., and the Longhorn Portland Cement Co., has been appointed mechanical engineer of the crusher and process machinery division of the Nordberg Manufacturing Co., Milwaukee, Wis. Born in Denmark, Mr. Wiese received his primary education in Aalborg and his technical engineering training at Polyteknisk Institute, Copenhagen. Since coming to the United States in 1921, Mr. Wiese has specialized in the design, engineering, construc-

George F. Wiese

tion and operation of cement plants. Prior to joining Nordberg Manufacturing Co., he was a sales engineer for Kennedy-Van Saun Manufacturing & Engineering Corp.

## Elected a Director

CRIS DOBBINS, president of Ideal Cement Co., Denver, Colo., has been elected a director of the Potash Co. of America, Carlsbad, N. M., to replace Arthur G. Rydstrom, who has resigned. Officers re-elected include C. K. Boettcher, chairman of the executive committee; G. F. Coope, president and treasurer; Homer Harris, vice-president and secretary; R. G. Haworth, production vice-president; George E. Petitt, sales vice-president; and Mason A. Lewis, general counsel.

## Products Manager

ROBERT L. ZALE has been appointed production promotion manager of the National Gypsum Co., Buffalo, N.Y. A graduate of the University of Missouri School of Journalism, Mr. Zale was formerly assistant to the advertising manager of the Toastmaster products division of McGraw Electric Co., Elgin, Ill.

## Secretary-Treasurer

WILLIAM A. MAPLES has been named secretary-treasurer of the American Concrete Institute, Detroit, Mich. He has been a member of the

William A. Maples

Institute staff for the past five years, serving as associate and managing editor of the Journal of the American Concrete Institute and as acting secretary-treasurer. A chemical engineering graduate of Michigan State College, East Lansing, Mich., Mr. Maples was formerly associated with the laboratories of the Ford Motor Co., and the Department of Public Works, City of Dearborn.

## Leaves Potash Firm

J. F. HAVARD has resigned as assistant resident manager of the Potash Company of America, Carlsbad, N. M., to accept the position of vice-president of Pabco Products, Inc., San Francisco, Calif., manufacturers of building and industrial materials. The company also operates a gypsum quarry in Nevada and a gypsum board manufacturing plant in Los Angeles.

## Secretary-Manager Resigns

CLIF HENDRICKSON has resigned as secretary-manager of the Concrete Masonry Manufacturers Association, Los Angeles, Calif., and will be succeeded by Neil W. Snow.

## To Assist Vice-President

CHARLES E. GREENLEE, research engineer, has been named assistant to the vice-president of sales, Basic Refractories, Inc., Cleveland, Ohio. For the past three years he has specialized in mineralogical studies of dead-burned dolomite and dead-burned magnesite. In his new position Mr. Greenlee will assist in development projects for new applications of the basic granular refractories being produced at Gabbs, Nev., and Maple Grove, Ohio. A native of Ohio, he served three years in the U. S. Air Force. He graduated from Ohio State University in 1950 with a degree as metallurgical engineer.

## P.C.A. Chairman

R. A. HUMMEL, chairman of the Lone Star Cement Corp., New York, N.Y., has been re-elected chairman of the board of directors of the Portland Cement Association, Chicago, Ill. New directors elected are: Charles Horner, president and general manager, Kosmos Portland Cement Co., Louisville, Ky.; Max E. Grunewald, president, Coplay Cement Manufacturing Co., Coplay, Penn.; Dwight A. Symmes, president, Glens Falls Portland Cement Co., Glens Falls, N.Y.; Waldo E. Tyler, president, Dewey Portland Cement Co., Kansas City, Mo.; and Frank B. Warren, president, Bessemer Limestone and Cement Co., Youngstown, Ohio. Retiring directors are: Thomas J. Harte, president, North American Cement Corp., New York, N.Y.; Eugene D. Hill, president, Louisville Cement Co., Louisville, Ky.; R. D. Raff, president, Diamond Portland Cement Co., Middle Branch, Ohio; Charles E. Shearer, president, Keystone Portland Cement Co., Philadelphia, Penn.; and Walter H. Wulf, president, Monarch Cement Co., Humboldt, Kan.

Mr. Hummel, who was elected chairman of the Lone Star Cement Corp. last year after serving 11 years as president, has been a member of the P.C.A. board of directors since 1941, and has served six times on the executive committee of the Association.

## Vice-President

A. BRIX-ANDERSEN has been appointed vice-president of F. L. Smidth & Co., New York, N.Y., to succeed

A. Brix-Andersen

George R. Nielsen, who has retired after 53 years of service with the company but remains as a member of the board of directors. Mr. Andersen, who graduated with a degree in mechanical engineering, has been with the firm for 20 years, serving previously in Europe, the Far East, Australia and New Zealand. He is a member of the American Institute of Mining and Metallurgical Engineers. Mr. Nielsen joined F. L. Smidth as a youth. He advanced through the shops and graduated as mechanical engineer in 1907, when he went to New York.

George R. Nielsen

After serving in the engineering, manufacturing and sales departments, he was appointed vice-president in 1940, which position he held until his retirement.

## Technical Representative

FRANK L. BREEN has been appointed technical field service representative in the research department of the National Gypsum Co., Buffalo, N.Y. He was formerly manager of the Trenton, N. J., plant and will be succeeded in this position by Robert L. Kilgore, formerly plant manager at Dover, N. J. Mr. Kilgore will be succeeded by Henry J. Reed as manager at Dover.

## Retires from Lime Firm

ELMER C. WALDEN, assistant treasurer of the New England Lime Co., Adams, Mass., has retired after 37 years of service. Mr. Walden joined the company in 1916 as bookkeeper at Danbury, Conn.

## Plant Manager

ARCH. MACINTOSH has been appointed manager of the concrete products plants of L. E. Shaw, Ltd., at Halifax and Sydney, Nova Scotia, Frederickton and St. John, New Brunswick.

## On A.S.T.M. Staff

FRED F. VAN ATTA has been appointed special assistant of the American Society for Testing Materials, Philadelphia, Penn. He was formerly manager of the building division, Carolinas branch, Associated General Contractors. Previously he was acting secretary-treasurer of the

Fred F. Van Atta

American Concrete Institute and editor of the ACI Journal. A native of Northville, Mich., Mr. Van Atta is a civil engineering graduate of Michigan State College. He joined the Michigan Engineering Experiment Station in research on aggregate, and later served with the Coast and Geodetic Survey, Tennessee Valley Authority, and for several years in the Los Angeles district of the Corps of Engineers. During World War II, Mr. Van Atta served as assistant to the district engineer, Charleston, S. C., in charge of planning and construction of aircraft warning stations, harbor defenses, concrete and timber wharves, and concrete and asphalt paving.

## Safety Director

WILLIAM J. FIKE has been appointed safety director at the Maple Grove, Ohio, plant of Basic Refractories, Inc., Cleveland, Ohio. A graduate of Kent State University in 1948, Mr. Fike will be responsible for the development of a safety program for the company's 500-acre quarrying, crushing and burning facilities.

## District Manager

LINTON J. KOLLER, formerly assistant district manager in the New York office of the National Gypsum Co., Buffalo, N.Y., has been appointed district manager of the Garwood sales district, which was previously part of the New York sales district and includes the state of New Jersey and Dutchess, also the counties of Orange, Rock Sullivan and Ulster in New York and the county of Litchfield in Connecticut. A graduate of Brown University, Providence, R. I., Mr. Koller was manager of the Allentown, Penn., office of Lehigh Portland Cement Co. before joining the National Gypsum Co.

## General Superintendent

NORRIS MILLER has been appointed general superintendent in charge of production and maintenance for the Battle Creek Gravel Co., Battle Creek, Mich.

## Plant Manager

J. W. RICHARDS has been appointed plant manager of Osceola Cement Products, Kissimmee, Fla., to succeed R. E. Tindall, who has resigned. He was formerly plant foreman.

## Guest Speaker

CLARENCE A. SANBORN, president of the Casey Stone Co., Casey, Ill., was guest speaker recently at a meeting of the Robinson, Ill., Rotary Club.

## OBITUARIES

C. B. CULLOR of the Cullor Limestone Co., Fort Scott, Kan., and his wife met death suddenly when their private plane crashed north of Kansas City in Platte County recently. They had spent the day with friends and relatives at Unionville where they had flown early that morning from their home at Fort Scott. They took off from the Unionville airfield at 9:00 p.m. Friends who accompanied them to the field said that Mr. Cullor was a very careful pilot and had checked his gasoline supply before departing. A possible explanation is that weather and fog caused them to lose their bearings and that in searching for a landmark their plane was too close to the ground. Mr. Cullor, a partner with R. W. Cullor in the Cullor Limestone Co., was a member of the Missouri Limestone Producers Association, Jefferson City, Mo.

ARTHUR K. GILKEY, son of Mr. and Mrs. Herbert J. Gilkey, Ames, Iowa, was a member of the ill-fated expedition which failed in its attempt to scale the 28,250-ft. Mt. Godwin-Austen in Pakistan and which cost his life in an avalanche on August 10. Mr. Herbert Gilkey is a former president of the American Concrete Institute. The story of the expedition appeared in one of the early November issues of the *Saturday Evening Post*.

GUSTAVE H. FAIST, vice-president and sales manager of the Gibsonburg Lime Products Co., Gibsonburg, Ohio, died October 31 after a short illness. He was 69 years old. Born in Woodville, Ohio, Mr. Faist started his career in the lime industry in 1904, when he became associated with the late J. J. Urschel, founder of the Woodville Lime Products Co. He remained there for 26 years, subsequently becoming sales manager. In 1932, he joined the late W. H. Price in the Gibsonburg Lime Products Co. and became vice-president and sales manager. Mr. Faist was active in affairs of the lime industry and was one of the organizers of The Finishing Lime Association of Ohio in 1926, serving five years as treasurer.

WILLIAM N. WORRALL, Kennett Square, Penn., owner and operator of the Avondale stone quarry in Kennett Square until his retirement in 1951, died October 29. He was 71 years old. At the time of his retirement Mr. Worrall sold his business to his nephew, Sharpless W. Worrall, who had been associated with him for several years.

WILLIAM SCOTT, a designing and mechanical engineer with Universal Atlas Cement Co., New York, N.Y., died suddenly on October 19. He was 70 years old. Born in Bradford, England, Mr. Scott came to the United States after being graduated from Bradford College. He was a member of the American Society of Civil Engineers and of the American Society of Mechanical Engineers.

ALFRED SOLBY ROGERS, president of St. Mary's Cement Co., Ltd., and Canada Building Materials, Toronto, Canada, died suddenly on October 30. He was 79 years old. Mr. Rogers, who owned some of the finest hunting and saddle horses in North America, started his business career in his father's concern, the Elias Rogers Coal Co., which he purchased in 1912.

JOSEPH P. TUFTS, vice-president and general manager of the Pre-Cast Concrete Products Co., Long Beach, Calif., died October 12 at the age of 51. Mr. Tufts was with the Housing and Home Finance Agency, Washington, D. C., until July 17, when he went to Long Beach to join the concrete products firm.

FRED REEVES, retired general manager of the Sibley Cement Co., Sibley, Iowa, died suddenly on November 7. He was 62 years old and until his retirement in 1951 had been associated with the company for 32 years.

BARRY I. MEYER, assistant secretary-treasurer of the General Portland Cement Co. and the Consolidated Cement Corp., Chicago, Ill., died October 30. He was 60 years old.

MCCLELLAND WAGGONER, retired concrete block manufacturer of Dayton, Ohio, passed away November 9 after a short illness. He was 89 years of age.

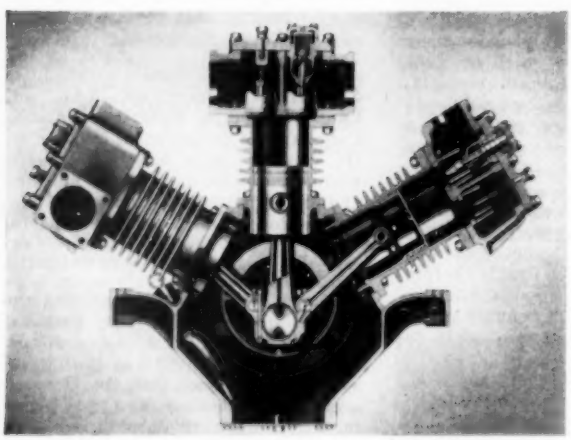
# If you believe

# ALL COMPRESSORS ARE ALIKE...

| | | | | |
|---|---|---|---|---|
| 600 | 134 | 202 | 68 | 33.7 |
| 315 | 75 | 117 | 42 | 35.6 |
| 210 | 51 | 78.5 | 27.5 | 35 |
| 160 | 37 | 57 | 20 | 35 |
| 105 | 25 | 42.5 | 17.5 | 41.6 |

## check these three points

**1 . RESERVE POWER.** There's plenty of that built into every Blue Brute. That means it takes thousands of hours of normal operation before engine wear affects the compressor's output.



**2 . EASY MAINTENANCE.** All parts of the Blue Brutes are readily accessible. No special tools or complicated disassembly procedures are needed. And the compressor uses the same oil as the engine.

| | | | |
|---|---|---|---|
| 60' | GASOLINE | 1.31 | 1.42 |
| 105' | GASOLINE | 2.16 | 2.35 |
| | DIESEL | 1.66 | 1.73 |
| 160' | GASOLINE | 3.18 | 3.44 |
| | DIESEL | 2.45 | 2.60 |
| 210' | GASOLINE | 4.32 | 4.70 |
| | DIESEL | 2.89 | 3.06 |
| 315' | GASOLINE | 6.25 | 6.75 |
| | DIESEL | 4.38 | 4.64 |
| 600' | DIESEL | 6.30 | 9.20 |

**3 . FUEL ECONOMY.** How does your compressor stack up in comparison with the Blue Brute for economical fuel consumption? The figures shown have been determined under normal field operating conditions.

Get all the facts about the Blue Brute from your nearest Worthington distributor. Or write to Worthington Corporation, Construction Equipment Division, Section H.3.6, Plainfield, New Jersey.

**WORTHINGTON**

*IF IT'S A CONSTRUCTION JOB, IT'S A BLUE BRUTE JOB*

H.3.6

ROCK DRILLS • WAGON DRILLS • PAVERS • CONCRETE MIXERS • PORTABLE PUMPS

# industry news

## Cover Picture

INTERNATIONAL MINERALS AND CHEMICAL CORP., Bartow, Fla., has one of the most modern phosphate mining and processing operations at its Noralyn plant. In this issue is an interesting article on the part that instruments play in the numerous automatic controls in the beneficiation process which makes possible maximum recovery of phosphate from the matrix. The article describes the instruments and how they function in the processing, and the care which is exercised in keeping them in working order. The cover illustration shows a general view of the plant and the shipping facilities.

## Plans Cement Plant

ST. LAWRENCE CEMENT CO. is planning an $11,000,000 cement plant in Villeneuve, Que. Production has been tentatively scheduled to begin in September, 1955, with an annual production of approximately 6,000,000 bags of cement. The company's limestone deposits at Villeneuve are expected to provide raw material for about 100 years or more. Major interests in the firm are held by 20 cement companies throughout the world, including the Swiss Holderbank Co. Bernard Ulrich is general manager of the company.

## To Install Dust Control

NATIONAL GYPSUM CO., Buffalo, N.Y., recently announced through President Lewis R. Sanderson that the company's board of directors has authorized $250,000 for installation of dust control equipment at its Fort Dodge, Iowa, plant. Electric precipitators, similar to those installed in 1947 on the plant's driers, will be installed on the calcining kettles. The project is expected to be completed by June, 1954.

## Company Dissolves

MCCRADY-RODGERS CO., a sand and gravel firm of Harmarville, Penn., was granted permission to complete its dissolution by the federal court. The company was one of eight defendants involved in anti-trust action based on alleged price fixing in the sale of sand and gravel. The company pleaded no defense and paid fines totalling $11,000. The government had compelled the firm to post a $25,000 bond to guarantee that it would not go out of existence until the anti-trust charges were disposed of.

## Stone Quarry

LANCASTER CORP., Dunkirk, N.Y., recently announced plans for a stone quarry and crushing plant near Cobleskill, N.Y. The plant location will be outside city limits, due to the opposition of local residents and other civic and business groups to the establishment of the plant within the village. The quarry site currently being considered is located about one mile from the village on the William Walker farm property, where quarrying operations were formerly carried on by Norton Stone & Lime Corp.

## Sand and Gravel Plant

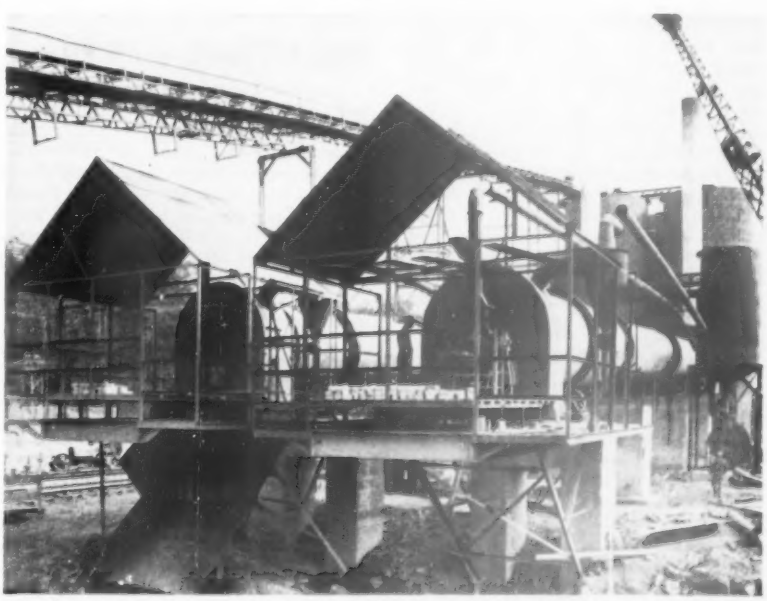
GLENDALE SAND AND GRAVEL CO. recently completed an expansion program at its Glendale, Ariz., plant, increasing capacity to 1000 tons of aggregate daily. Much of the plant's production is being used by the Luke Air Force Base for the new jet plant parking mat, involving a 46,000 cu. yd. concrete pour.

The Glendale plant now covers 220 acres, with ten acres devoted to two screening and washing plants, a ready-mixed concrete plant, and sand and gravel stockpiles. One stockpile contains 75,000 tons of washed concrete sand, said to be the largest in the Southwest.

## "Solite" Lightweight Aggregate Plant

THE CAROLINA SOLITE CORP., a subsidiary of Southern Lightweight Aggregate Corp., Richmond, Va., has begun operations on a seven-day week schedule at its Solite plant in Aquadale, N. C. The recently constructed $1,000,000 plant will supply Solite, a controlled lightweight aggregate used in the production of structural concrete and lightweight masonry units. The plant site is the first of several recently purchased slate deposits to be activated by Southern Lightweight Aggregate Corp.

The process for manufacturing Solite is similar to that used in the production of portland cement. Slate is run through primary crushers and screened to size, it is then processed in constantly revolving kilns fired to approximately 2300 deg. F., expanding the shale to form millions of air cells. This provides a lightweight and a natural insulation product which is allowed to cool normally to produce a thoroughly annealed product. Masonry units made from Solite are said to be fireproof, sound absorbing, rust and stain proof, and natural insulators.



Overall view of Carolina Solite Corp.'s $1,000,000 lightweight aggregate plant at Aquadale, N.C.

## Silica Processing Plant

STONY RIDGE SILICA CORP., Lehighton, Penn., recently completed and began operation of its new $250,000 silica-processing plant at Little Gap, Penn. The company will also produce concrete sand as a by-product.

According to company officials, the sand has been tested and approved for highway construction by the Pennsylvania Department of Highways. Plant production will be about 200 tons of sand per hour.

The new silica-processing operation reportedly has a backlog of orders which will insure a continuous work schedule for many years. Much of its product will be utilized by major steel corporations and other businesses using open-hearth furnaces. The physical structure of the silica found in Little Gap is said to be of outstanding quality and will permit production of superior silica brick.

Directors of the company are Albert J. Prutzman, James Fauzio, John G. Cipko and John Cooper. Other personnel include Mrs. Verna Rehrig, secretary-treasurer, and Lloyd Green, plant superintendent. Operation of the plant and the loading of materials are directed by Fauzio Bros., Nesquehoning, Penn.

## Universal Atlas Expansion

REBUILDING of the 47-year-old Universal Atlas Cement Co. plant at Universal, Penn., underway since last May, is about one-third completed, as announced by Blaine S. Smith, president. Mr. Smith stated that the new plant is a result of almost 10 years of intensive research and experiment by company engineers, under the direction of H. P. Reid, vice-president in charge of engineering.

Design of the new plant calls for three new buildings to replace the four which now house the coal mill, raw mill, firing department and finishing mill. Razing the old buildings and erection of the new are being accomplished without interruption of daily production. New construction and installation of equipment are expected to be completed late in 1955. The new plant reportedly will be one of the most modern in the United States. E. F. Harchelroad, who has been associated with the Universal plant for 38 years, and plant manager since 1950, will be in charge of the new operation.

## Operations Televised

MATERIAL SERVICE CORP.'s sand and gravel and ready-mixed concrete operations were recently filmed and televised over NBC-TV as a part of a weekly television series, "Industry On Parade," which is seen in over 125 cities. Each step in the production of concrete aggregate and ready-mixed concrete was shown beginning with a scene from the company's gravel operations at Plainfield, Ill. Other scenes included hauling gravel to the Lockport, Ill., plant on the corporation's diesel train, and gravel processing at the plant. Action shots of the company-owned towboats were shown unloading at the Chicago yards, as well as the stockpiling, conveying system, and ready-mixed concrete operations at the yards. Final scenes showed a transit-mixer enroute to a job and concrete being poured for a foundation wall of a Chicago skyscraper.

## Cement Company Advertises Industry

IDEAL CEMENT CO., and Precon Co., Inc., both of Denver, Colo., recently joined with Colorado's Department of Development and nine other leading business concerns in an effort to focus national attention on Colorado's expanding industrial potential, by means of a 12¼-page advertising section in the October issue of *Fortune*. The section, entitled, "The Colorado Story," utilizes "editorial style" copy and a series of advertisements.

## Japan Cement Production

THE JAPAN CEMENT ASSOCIATION has announced a drop of cement production in Japan for September of 768,837 tons from the all-time high in August of 798,618 tons. Exports in September decreased to 42,099 tons from 82,341 tons in August. The association expects the cement demand to reach 10,000,000 tons in 1957, with annual exports from 1954 to 1957 to average 1,200,000 tons. The total cement demand for the 1953 fiscal year is also expected to exceed the current forecast of 8,400,000 tons, and exports during 1953 will be approximately 800,000 to 900,000 tons.

## May Reopen Gypsum Plant

UNITED STATES GYPSUM CO., Chicago, Ill., recently announced that it is considering plans for reopening its Eldorado, Okla., plant, if investigation reveals suitable rock in sufficient quality and quantity can be found there. The plant, which formerly produced brown plaster, would be converted into a sheet rock and casting plaster processing plant.

## Retires R.F.C. Loan

GIANT PORTLAND CEMENT CO., Philadelphia, Penn., has retired a 5 percent Reconstruction Finance Corp. loan by taking a $2,000,000, 5-year, 4½ percent interest loan from a bank, as recently reported in *The Wall Street Journal*. The R.F.C. loan, originally exceeding $4,000,000, had been reduced by periodic payments to about $3,112,000. Company funds, accumulated for the purpose, were added to the bank loan to retire the R.F.C. loan in full.

## Brazil Wants Cement Plants

ANNOUNCEMENT was recently made by the director of the Brazilian Government Trade Bureau that a major step is being taken by the Brazilian government to speed expansion of cement production through stimulation of investment by foreign and domestic capital. According to the announcement, the action by the Brazilian government would allow bonafide cement companies, which establish cement plants in Brazil, or expand existing facilities, to claim exemption from import duties and related taxes. The exemption would cover machinery and tools, equipment used to extract raw materials, and equipment needed for producing and transmitting power to operate cement plants.

Present cement production in Brazil is at an annual rate of 2,300,000 metric tons. Imports in 1952 amounted to 820,000 tons, while domestic output was 1,600,000 tons. There are 14 cement plants in operation, with others in various stages of planning or construction. Mineral raw materials are said to be available in many areas of Brazil, close to industrial centers.

Companies wishing to take advantage of the exemption reportedly must comply with the following requirements: Be incorporated in Brazil; have a capital of at least 25 million cruzeiros (about $650,000 at the free exchange rate); plan a 30,000-ton plant; have access to mineral deposits sufficient for 15 years' supply; and guarantee to begin production within 18 months.

## Asbestos Plant

ASBESTOS MINING CORP., New York, N.Y., recently revealed plans to build a $2,000,000 asbestos mine and plant near Copperopolis, Calif., on property formerly known as the Voorhees asbestos property. The operation will employ about 200 persons. The company has applied for permission from the Calaveras County Board of Supervisors to build a privately financed road to the proposed mine and processing plant.

## Buys Gravel Company

ALEXANDER SAND AND GRAVEL CO., Albuquerque, N. M., has been purchased by Albuquerque Gravel Products Co. L. D. Alexander, former owner of the purchased company, has been named manager of the Albuquerque Gravel Products Co. aggregate plant at Albuquerque, N. M.

## Crushed Granite Plant

THE MONTELLO CRUSHED GRANITE CORP., recently began operations at Montello, Wis. One of the uses of the crushed granite will be for poultry grit.

## Self-Unloading Vessel for Limestone

THE S. S. JOHN J. BOLAND, large new lake boat equipped with self-unloading machinery capable of discharging an 18,000-ton cargo of limestone in four hours or less, was recently placed into service by American Steamship Co. of Buffalo, which owns 17 other vessels on the Great Lakes for the transportation of limestone, gypsum, coal and coke. The new boat, built in Manitowoc, Wis., at an estimated cost of $6,700,000, has a 601-ft. keel, 21 ft. longer than the company's next largest boat. It burns coal and travels at a speed of 16¼ m.p.h.

The self-unloading equipment, designed by Hewitt-Robins, Inc., reportedly transfers cargo from ship to shore at least one-third faster than older conventional unloaders. A conveyor and elevator system in the hold brings the cargo to deck level, where it is automatically transferred to another conveyor mounted on a 250-ft. boom which swings out from the side of the boat and deposits the material on the shore without the aid of any land-based equipment.

## Purchases Gravel Plants

PETER LIND & CO., a general contracting firm of London, England, in association with Locana Corp., an investment and development company of Montreal, Que., has purchased the share capital of two Canadian sand and gravel companies, Lockyer & Hughes Ltd., and Highland Creek Sand & Gravel Ltd. The two companies have sand and gravel deposits in Scarborough and Pickering Townships east of Toronto, and a single crushing and screening plant in Scarborough Township. The purchase was handled through Canadian subsidiaries of Peter Lind & Co., which were in the process of formation. Locana Corp., recently formed by British financial interests, holds a minority interest in the purchase.

## Alumina Plant

ALUMINUM CO. OF AMERICA has announced that its new chemical products plant at Bauxite, Ark., under construction since last March, is scheduled to begin operation about April 1, 1954. The plant, built at a cost of approximately $5,000,000 will be operated as a unit of the Alcoa Bauxite Alumina Works.

## Perlite Processing Plant

TENNESSEE PRODUCTS AND CHEMICAL CORP. has begun operation of its new $145,000 perlite processing plant at Jacksonville, Fla. Initial plant production is about 1500 bags of perlite per day. At present the plant is operating only one shift per day. Two more units are to be added to the plant later, as the marketing area expands. Chief markets at present are in the Carolinas and Georgia, according to H. M. Bradley, plant manager. Tennessee Products also operates perlite plants in Nashville, Tenn., and Little Rock, Ark.

## New Talc Plant

REYNOLDS TALC CO., Gouverneur, N.Y., recently incorporated, has announced plans to build a new talc mining and processing plant in the Talcville section, east of Gouverneur. The construction contract has been awarded to Rouse Construction Co., also of Gouverneur.

## Buys Sand and Gravel Plant

CEMSTONE PRODUCTS CO., St. Paul, Minn., has announced the purchase of an additional sand and gravel plant at Lakeland, Minn. The plant was formerly owned by Lakeland Sand & Gravel Co.

## Buys Mining Claims

URANIUM-FLUORSPAR DEVELOPMENT CORP. has purchased six mining claims and filed five location certificates in the Unaweep District of Colorado.

## Cement Plant Expands

SOUTHWESTERN PORTLAND CEMENT CO., Victorville, Calif., is expanding its plant facilities with the addition of a kiln costing over $1,000,000. The kiln will produce 2500 bbl. of cement daily, bringing plant production to a total of 12,000 bbl. daily. A new office building, change room and landscaping were recently completed as a part of the expansion program.

## Closes Old Lime Plants

THE J. E. BAKER CO., York, Penn., and LOUISVILLE CEMENT CO., Milltown, Ind., recently announced the closing of their lime plant operations, each of which had been in operation for more than 50 years.

## Adds Cement Silos

DEWEY PORTLAND CEMENT CO. is adding eight 144-ft. diameter cement storage silos at its Linwood, Iowa, plant. The silos, which are a part of an overall expansion program at the Linwood plant, will have a 20,000-bbl. capacity each, and will augment the 40 cement storage silos now in use at the plant.

## Coming Conventions

**January 5-7, 1954—**
**American Road Builders' Association, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.**

**January 19-20, 1954—**
**Concrete Products Association, Plankinton Hotel, Milwaukee, Wis.**

**February 8-11, 1954—**
**National Concrete Masonry Association, 34th Annual Convention, Shoreham Hotel, Washington, D. C.**

**February 14-18, 1954—**
**American Institute of Mining & Metallurgical Engineers, Annual Meeting, New York, N.Y.**

**February 15-19, 1954—**
**National Ready Mixed Concrete Association, 24th Convention and Exposition, Conrad Hilton Hotel, Chicago, Ill.**

**February 15-19, 1954—**
**National Sand and Gravel Association, 38th Convention and Exposition, Conrad Hilton, Chicago, Ill.**

**February 18, 1954—**
**National Agricultural Limestone Institute, Board of Directors Meeting, Blackstone Hotel, Chicago, Ill.**

**February 19-20, 1954—**
**National Agricultural Limestone Institute, Annual Convention, Blackstone Hotel, Chicago, Ill.**

**February 22-24, 1954—**
**National Crushed Stone Association, 37th Annual Convention and Manufacturers Division Exposition, Conrad Hilton Hotel, Chicago, Ill.**

**February 24, 1954—**
**American Concrete Agricultural Pipe Association, 4th Annual Convention and Meeting, The Fairmont Hotel, San Francisco, Calif.**

**February 25-27, 1954—**
**American Concrete Pipe Association, 46th Annual Convention and Meeting, The Fairmont Hotel, San Francisco, Calif.**

# HH

## Tailing Launders

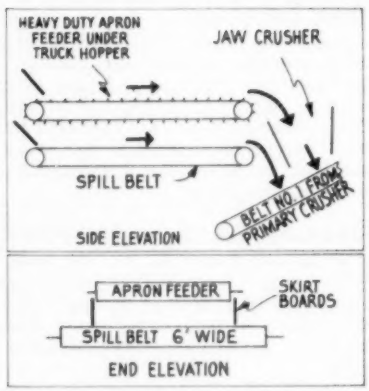
AN EASTERN SAND AND GRAVEL PLANT, which is located in an area having strict laws regarding stream pollution, has provided three ponds

**Launder serving tailing pond consists of large-diameter steel pipe, split in half along axis. Two smaller launders also serve this pond**

for handling the tailings from the plant operations. The ponds, two covering two acres each and one covering one acre, have been dyked so as to permit a 10-ft. depth of material in the settling areas. Overflows can be directed to the creek nearby or in series. The illustration shows one of three launders serving one of the ponds. It consists of a large-diameter steel pipe, split in half along its long axis. The other two launders going to this pond are much smaller in diameter as the g.p.m. is relatively light. Fresh water is pumped to the plant at a rate of 3500 g.p.m., so the ponds can handle practically all of that flow adequately.

## Prevent Apron Feeder Spillage

SPILLAGE FROM AN APRON FEEDER usually presents a burdensome chore as the aprons are often located in a pit or depression and the debris has to be shoveled out periodically. One eastern dolomitic limestone producer successfully solved this problem by installing a short 6-ft. wide, flat-running, 4-ply conveyor belt directly beneath the apron feeder which is located under the truck hopper serving a 36- x 48-in. primary jaw crusher. The spill belt is driven from the apron feeder and operates at about the

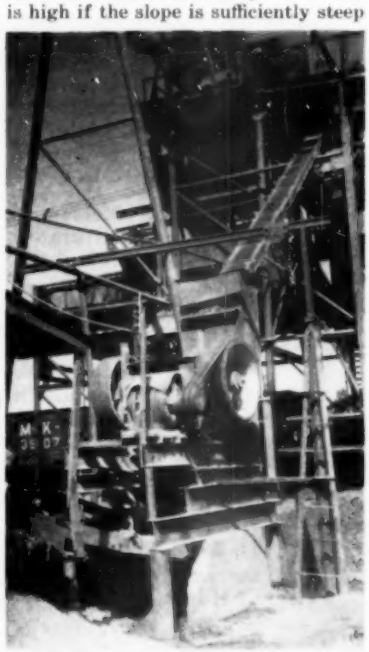



**Sketch shows details of apron-feeder installation. Skirt boards, extending downward from feeder to spill belt, prevent spillage**

same number of feet per minute as the feeder. Flash skirt boards extend downward from the feeder to the spill belt. These, with the wide belt used, keep the area under the feeder assembly clear of fine rock fragments. The spill belt unloads to the same conveyor belt that receives the crushed stone from the primary crusher.

## Conveyor Chute Vs. Bin Installation

LONG CHUTES for conveying coarser fragments of rock, as a rule, are not considered too satisfactory. The wear is high if the slope is sufficiently steep



to insure against hang-ups, while too flat a chute is obviously useless in this capacity.

The two illustrations shown were taken at two different plants, both owned by the same company. The one shows a long chute from the scalper screen to the 1040 Austin-Western jaw crusher. (Note how the foundation is made up of a series of heavy channel iron sections) The second illustration shows a similar set-up; this plant originally also had a long chute from the screen, high in the plant, to the crusher. The chute was later replaced with a small steel hopper-bottom bin (shown in the illustration), installed ahead of the double-roll Cedarapids crusher and the 3-ft. Symons cone behind and alongside the roll unit. The small bin ahead of the crusher is fed by a short stub belt conveyor. Both crushers are fed from the bin by gravity-type gates. This latter installation reportedly has proven more satisfactory than the long-chute system previously used.

## Care of Haulage Ropes

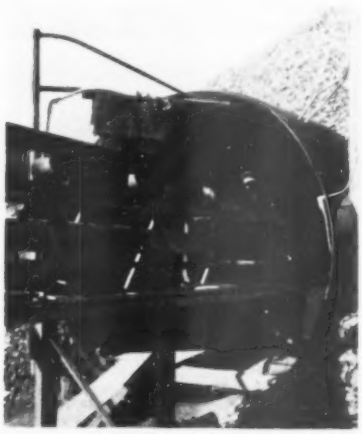
A ROCK PRODUCTS reader has offered the following suggestion for the internal lubrication of haulage ropes. He states that the use of a thin lubricant for the internal lubrication of haulage ropes is often at the expense of efficient lubrication and that even the most efficient lubricant may fail to penetrate to the core. He suggests that the rope should first be cleaned

**Left: Long conveyor chute extends from scalper screen to jaw crusher. Right: Small steel hopper-bottom bin replaces chute; bin is equipped with gravity-type gates**

and then the wire strands be slightly raised by means of a magnetic bar, thus aiding or allowing better penetration of the lubricant.

## Removing Tramp Iron From Product

AT AN EASTERN CRUSHED STONE PLANT, a surge pile of minus 3-in. stone is maintained over a reclaiming tunnel. This stone is a source of smaller aggregate which is processed nearby in a triple-roll crusher set-up. As the conveyor belt from the reclaiming tunnel emerges, any tramp iron in the product is removed by a small magnet that hangs over the belt. The magnet assembly is so mounted that it can be swung to one side when any metal is collected.



**Magnet over conveyor belt from reclaiming tunnel collects tramp iron from the product, thus preventing damage to the crushers**

## Transporting Drill Rig

A PENNSYLVANIA LIMESTONE PRODUCER has an operation capable of producing 200 to 350 t.p.h., depending on sizes being produced. It was found that the rotary drill rig that had been purchased had considerably more capacity than needed in this operation, so a drilling schedule was worked out to do contract drilling in the local area. This, however, involved transporting the tractor-mounted drill over state highways. The problem was solved by the following simple method. When it is necessary to move the drill over a highway, the rear end is jacked up and a dual tire assembly is pushed under it. Similarly, the front end is raised and the tractor backed under it. Provision has also been made for locking the wheel assemblies to the drill rig for safety precautions. The accompanying illustration shows the assembled rig ready for transportation.

**Drill rig is transported over highways by means of dual tire assembly supporting rear end of rig and tractor supporting the front end**

## Conveyor Assembly

A TEXAS SAND AND GRAVEL PRODUCER had to build an expensive steel suspension-type bridge to carry a field belt that delivered sand and gravel to the plant from a deposit across the river. Steel towers on each bank supported the sky-lines which in turn supported the conveyor. The conveyor was assembled in two sections, one on each bank of the stream. Heavy-duty sheaves were so mounted on the sky-lines that they could carry the conveyor assemblies to mid-stream by an "end-O" method of progressively moving the long sections to their meeting point in mid-stream where they were joined together. One interesting feature was that the carrying sheaves were lined with babbit metal so as not to damage the galvanized coating on the sky-line cables.

**Suspension-type bridge carries field belt which delivers sand and gravel to plant from deposit across the river**

## Car-Loading Set-Up

AT A NEW AND MODERN lightweight aggregate plant in the Louisville, Ky., area, the finished sizes of material are ground-stored, with a reclaiming belt operating in a tunnel under the piles.

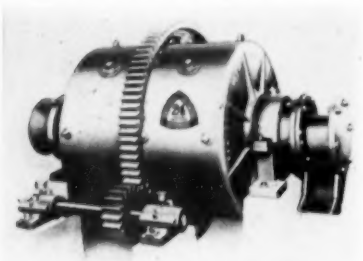
For car loading, a steel pipe chute, hinged or pivoted at the top, has been provided. When an open-top car is to be loaded, the loading spout is swung around in the position as shown.

**Left: Car-loading chute is to one side when not in use. Right: Chute has been swung around into position for car loading**

# NEW Machinery

## Ball Mills

DENVER EQUIPMENT CO., 1400 Seventeenth St., Denver 17, Colo., has announced production of a 30-in. "Economy" ball mill. The standard mill has an alloy iron shell; hard iron



Left-hand ball mill

liners; cast tooth gear; drum or reversible scoop feeder with a Decolloy, a nickel-iron alloy, wearing lip; and steel-cast tooth pinion gear. Shell and head liners of materials such as manganese steel or Decolloy are available. The mill is available in a 18- x 30-in. size with small or large trunnion openings, and in 30- x 36-in. size with a small opening only. Right or left hand drives are available and cut-tooth gears may be supplied.

## Automatic Welder

MIR-O-COL ALLOY CO., 312 North Avenue 21, Los Angeles 31, Calif., has announced the Mir-O-Col K-2, an automatic machine for rebuilding wheels, pulleys, track rollers, idlers and cones. The rebuilder can handle work up to 40 in. in diameter and takes automatic wire up to ¼ in. in size. A center lock prevents slippage and insures concentric build-up while

Welder with automatic positioner

a gear reducer permits variable spindle speeds from ¼ to 3 r.p.m. The machine also has an automatic welding positioner, a simplified control panel, and an adjustable welding table. Separate rack and pinion assemblies enable one operator to rebuild two pieces of equipment simultaneously.

## Agstone Spreader

HIGHWAY EQUIPMENT CO., INC., 616 D Avenue N.W., Cedar Rapids, Iowa, has introduced its 1954 model "New Leader" twin-disc agricultural limestone spreader, re-designed from previous models to incorporate a wide 24-in. conveyor which permits a lower center of gravity, steeper sides, and a greater payload. High tensile, abrasion-resistant steel construction is featured, and twin distributor discs are retained as standard equipment. The

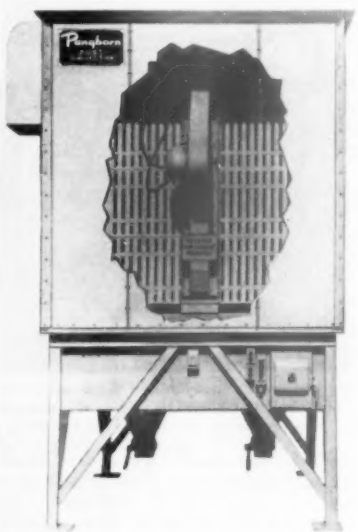
Twin distributor discs turn outward from the center, evenly distributing agstone the width of the spread

discs turn outward from the center, distributing the material evenly through the entire width of the spread. The truck body has been redesigned for better weight distribution, and V-belt drive has been added. Other features include an aluminum gear-case to resist corrosive action, improved gear boxes, boxed-in top edge and internal gussets for greater strength.

## Dust Collector

PANGBORN CORP., Hagerstown, Md., has introduced the type CH-3 self-cleaning cloth screen dust collector which utilizes the reverse air flow principle for continuous cleaning of its cloth filters. A traveling manifold with integral reverse air blowers takes air directly from the clean air side of the collector to clean the filters. The mechanical arrangement causes the air to be blown from all external surfaces of the filter elements and allows it to drop into the hopper instead of being re-entrained. This arrangement is also said to prevent air short-circuiting. The manifold travels at slow speeds in both forward and reverse directions by means of a reducer and fractional horsepower motor controlled by a limit switch and magnetic reversing starter.

Standard size collectors have six-screen-high construction. Four and five-screen-high by 5 ft. long screen

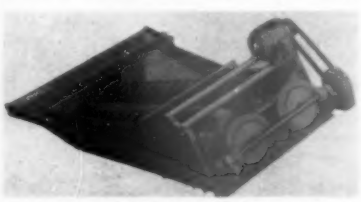



Self-cleaning cloth screen dust collector utilizes reverse air flow principle

sections are also available for small air volume problems. Other features include all steel wire mesh screen frames; inherent electrical grounding on the frames; all moving parts of the cleaning mechanism located on the clean air side to eliminate wear; and accessibility of both dust and clean sides for inspection. Present type CH cloth screen collector installations may be converted to the self-cleaning arrangement.

## Screw Washer

MCLANAHAN AND STONE CORP., Hollidaysburg, Penn., has developed a series of screw washers in single and double screw models for either fine or coarse materials. With screw lengths of 20 and 25 ft., the washer produces sand with 12-15 percent moisture and 10-12 percent moisture, respectively.



Washer is available in single and double screw models

The single screw units have capacities ranging from 35 to 125 t.p.h., while the double screw units produce at rates from 70 to 250 t.p.h., based on plus 100 mesh materials. The retention or rejection of fines can be controlled by the varying of three adjustments on the washer. Anti-friction, grease-lubricated bearings are used throughout. Large settling areas, enclosed reduction drives and flights of cast chilled iron are also included.

## R.P.M. Recorder

MONTGOMERY & Co., INC., 53 Park Place, New York 7, N.Y., has announced a portable instrument for instantly checking the r.p.m. of motors, machinery, revolving shafts, etc. The instrument's rubber tip is placed against the revolving shaft and a dial reading is immediately given. The minimum recorded speed is 40 r.p.m., the maximum, 50,000 r.p.m.

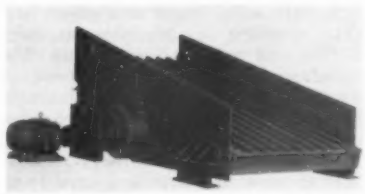
Instrument records motor r.p.m.

## Multiwall Bag Valve

ARKELL AND SMITHS, Canajoharie, N.Y., has introduced its patented multiwall bag valve, the "Lock-Rite." The valve is for use on pasted multiwall bags, and is designed to reduce the sifting of finely pulverized materials from the bag.

## Scalping Screen

LINK-BELT CO., 307 N. Michigan Ave., Chicago 1, Ill., has announced a heavy-duty scalping screen with a rigidly welded frame structure, built to withstand severe vibration and impact loading. The deck, of welded, stress-relieved construction, can be furnished either with grizzly or heavy perforated plates with riding bars. Twelve helical springs isolate vibration and impact shocks from the support base, and the full-floating mechanism is completely enclosed, equipped with automatic controls for limiting motion during acceleration and deceleration. The screen drive consists of a high-starting torque, totally-enclosed, fan cooled, 1750 r.p.m. motor; V-belts; and a timing control device.



Heavy-duty screen has 12 helical springs to isolate vibration

## Cable Reel

LETOURNEAU-WESTINGHOUSE CO., Peoria, Ill., has brought out the "Tournarope Bantam Reel," a cable reel designed to save wire rope and dozer cable threading time. The 14-in. reel, which holds 150 ft. of ½-in. Tournarope, is designed as a storage reel, and is equipped with a bracket that can be welded or bolted to a tractor. The rope is threaded through the dead-end unit, through the sheaves and to the power control unit. When a section of rope shows wear, it may be cut off, and a section pulled from the storage reel to be reattached.

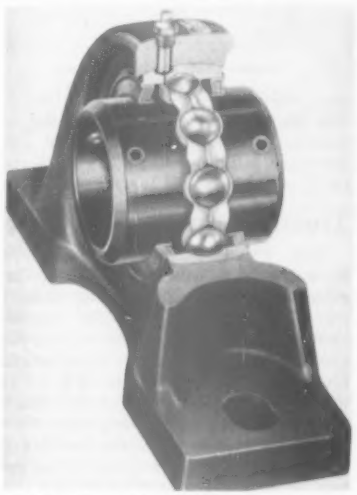
## Portable Conveyor

FRANK A. KREMSER & SONS, INC., 3435 N. 5th St., Philadelphia 40, Penn., has developed a portable conveyor with a power-operated safety screw lift and lowering device. It raises to any angle, and can be used for transporting bags or other packages from floor to floor when elevators are not available. The conveyor is built to operate low to the floor, it has no obstruction at the loading end so that pick-up may be made easily. Removable rubber cleats every 60 in. on the three-ply corrugated belt help prevent tearing of packages, and a reversible motor permits instant change of direction. It moves on ball bearing swivel casters and folds in half for easy storage.

Conveyor transports from floor to floor

## Ball Bearing Units

STEPHENS-ADAMSON MANUFACTURING CO., Aurora, Ill., has announced zone-hardened Sealmaster ball bearing units with a double extended race. The zone hardening process provides for induction heat treating the inner race ring through the ball section only, thus providing positive race to shaft locking. The double extension of the inner race ring gives maximum bearing support on the shaft and provides a positive lock between the inner bearing race and the shaft. Shock and vibration resistance, and shaft wear and fretting corrosion reduction are also claimed for the units.



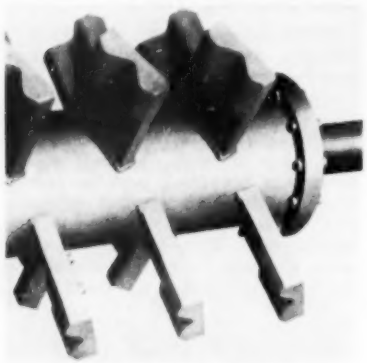
Ball bearings with a double extended race

## Manganese Welding Rod

WALL COLMONOY CORP., 19345 John R. Street, Detroit 3, Mich., has announced a manganese-nickel steel welding rod, designated "Walmang," for repairing or building up worn or broken manganese steel castings. It can also be used as a buildup material prior to applying Colmonoy hardfacing alloys to manganese steel parts. The weld metal is said to have good fusion, penetration and density characteristics, and thus to minimize the effects of the welding heat on the parent metal. The deposits have an initial hardness a little less than the 160-190 Brinell hardness of the parent manganese steel casting, but it is said to harden in use under deformation and impact to 450 Brinell and higher. The bare welding rod is applied with d-c welding equipment, while the coated rod can be applied by either d-c or a-c equipment. The rods are available in ¼-, 5/32-, 3/16- and ⅛-in. diameters, the bare rods being 18 in. long and the coated rods, 14 in.

## Log Washer Shaft

EAGLE IRON WORKS, Des Moines 13, Iowa, has brought out a tubular shaft or log for its log washers, as stand-



Tubular shaft for log washers

ard equipment or for replacement. The stub shafts are bolted to the log proper by means of flanges, to give accurate alignment and to provide easy replacement of worn stub shafts.

## Tractor Torque Converter

THE FRANK G. HOUGH CO., 705 Seventh St., Libertyville, Ill., has added a hydraulic torque converter to the Model HM "Payloader" tractor-shovel. This improvement is incorporated in the gas and diesel-engine models, as well as in the TM "Payloader" tractor, developed for heavy duty switching and towing operations. The converter is a three-element-type which multiples the engine torque output in direct proportion to the load

Hydraulic torque converter multiplies torque output in proportion to load requirements

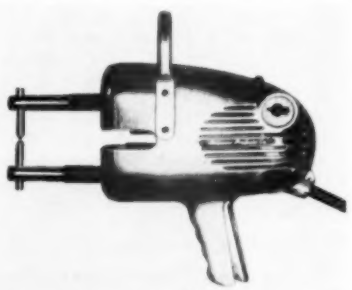
requirements. In conjunction with the four-speed, full-reversing transmission, it is said to provide a smoother tractor-shovel drive. The converter reduces the amount of necessary "clutching" and gear-shifting, and acts as a cushion for the entire power train, protecting against load shocks.

## Abrasion Protector Sheets

MAGIC CHEMICAL CO., 121 Crescent St., Brockton 2, Mass., has brought out "Iron-Rubber" protective sheeting, as an addition to its Magic-Vulc line. The protective sheeting is said to provide protection against abrasion and corrosion to all types of equipment including chutes, hoppers, launders, ball mills, ducts and pipes, etc. The sheeting is available in reinforced and non-reinforced types. The reinforced sheeting is composed of two sheets of rubber permanently bonded to a central core of expanded steel, and will stand on edge without buckling, bend to fit corners without spring-back, and can be shaped to fit almost any contour. The non-reinforced type is a single sheet of rubber and is more flexible than the reinforced type. The protective sheets are of lightweight and come in large sections, easily handled by one man.

## Portable Spot Welder

AMPOWER PRODUCTS CO., 5737 W. 87th St., Oak Lawn, Ill., has brought out Model 5201, a portable spot welder featuring an electronic timing control and a timing cycle from 1/60th of a second to a full second. It welds

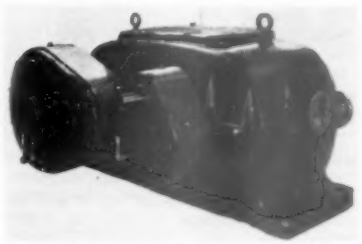


Spot welder features electronic timing control

most alloys of aluminum sheets, and steel, mild and stainless, galvanized and cadium plated. The welder has a pistol grip for easy operation and will weld as fast as the operator can squeeze and release the handle. The unit weighs 26 lb., and may be mounted on a stand, if necessary, for use as a foot operated floor model.

## Splash-Lubricated Drive

LINK-BELT CO., 307 N. Michigan Ave., Chicago 1, Ill., has added two 25-hp. P.I.V. variable speed drives to its line. In addition to the H-6 P.I.V. of 25 hp. capacity, an HG-6 drive can be furnished, with either a single reduction input or single reduction output helical gear attachment. An HGG-6 drive also has been added, which is furnished with both a single reduction input and single reduction output helical gear attachment. The input gear reductions are available from 1.93:1 minimum to 5.82:1 maximum, and output gear reductions from 1:1 to 6.33:1. Speed increasing gear sets are also available. The complete line includes drives in eight sizes, ranging from ½ to 25 hp., and ratios up to 6:1, in 16 types, for horizontal and vertical mounting, with and without helical gears and integrally mounted motor. The drives are fully enclosed and constructed entirely of metal. All moving parts are splash lubricated from a common reservoir.



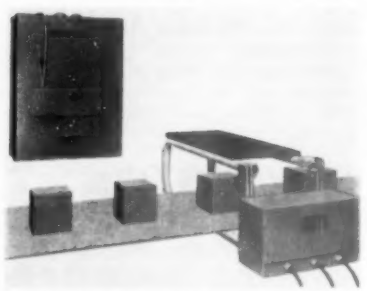
Drive of 25-hp. has single reduction input and an output helical gear attachment

The drive is said to be unaffected by high or low temperatures, humidity, abrasive dust or explosive vapor conditions. It is also said to transmit power positively, without slip, by means of a drive chain with self-forming metal teeth that engage with radial grooves in two pairs of cone-shaped wheels. The speed drive controls may be electronic, hydraulic, pnematic or mechanical.

## Metal Detector

GENERAL ELECTRIC CO., Schenectady 5, N.Y., has announced a general-purpose metal detector which can be installed around conveyor systems without cutting the belt. Belt speeds can range from 90 to 500 f.p.m. The equipment consists of two main components, an electronic cabinet with a gasketed door for dust-tight and moisture-resistant operation, and an inspection coil system.

Mounted on the outside of the control cabinet door are controls and indicators for operation of the equipment. A green light indicates when

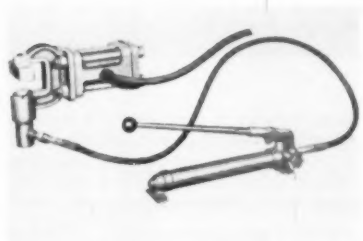


Detector, installed around conveyor belt, detects metal at speeds from 90 to 500 f.p.m.

power is applied, a red light is used as an alarm signal when metal passes through the coil unit, and a yellow light labelled "balance" indicates when the automatic balance system is not operating or is outside of its limits. Power requirements are 105/125 volts, 60 cycle, 150 watts.

## Portable Air Vibrator

THE CLEVELAND VIBRATOR CO., 2828 Clinton Ave., Cleveland, Ohio, has expanded its line of air vibration equipment to include a portable unit known as the Type HCRR. Equipped with a hydraulically-operated mounting clamp, it may be attached to a rail-



Air vibrator with hand-operated push-pull type pump

road car or other material handling device. The vibrator has a hand-operated push-pull pump and a 6-ft. hose assembly from the pump to the hydraulic cylinder.

## Heavy-Duty Alloy

STOODY CO., Whittier, Calif., has introduced an electrode particularly suited for hard-facing mining, crushing and other types of heavy equipment. The alloy, designated "Coated Tube Stoodite," has been subjected to various tests to determine its suitability for equipment of all kinds, and is known as "Experimental Electrode, Stoody 1293," to those who have assisted in the tests. With chromium and molybdenum as the principal alloys, the material is said to provide resistance to abrasion, high compressive strength and impact resistance. It is readily weldable to carbon and alloy steels including man-

Shovel bucket sides, lips and teeth are protected by hard-facing alloy

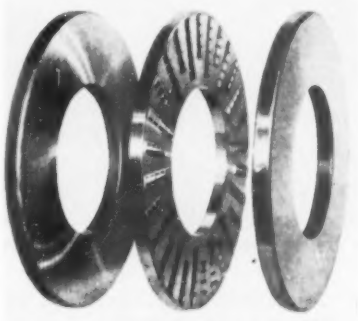
ganese, and provides semi-austenitic deposits, not affected by ordinary heat-treat methods. Under normal welding procedure, either a-c or d-c deposits show a Rockwell C hardness of 56-60. Properties are retained at temperatures up to 800 deg. F.

## Shielded Arc Electrode

THE LINCOLN ELECTRIC CO., Cleveland 17, Ohio, has announced an electrode known as "Jetweld," which incorporates powdered metal in the electrode coating. It is a heavily-coated, shielded-arc type for operation in flat or near flat positions with a-c or d-c current. The weld metal is uniform x-ray quality, and is said to be free from undercut providing a welded tensile strength of 93,000 p.s.i. and a yield point of 79,000 p.s.i. The slag produced curls off as it cools to make the welds almost self-cleaning. The welds are also said to be virtually spatter-free, with a smooth, stable arc action which is highly resistant to arc blow. It is a "drag" electrode, operated with the coating touching the work, and is available in $\frac{5}{32}$-, $\frac{3}{16}$-, and $\frac{1}{4}$-in. sizes.

## Thrust Bearing

ROLLWAY BEARING CO., INC., Seymour St., Syracuse, N.Y., has announced modifications in the T-59 high-capacity thrust bearing for

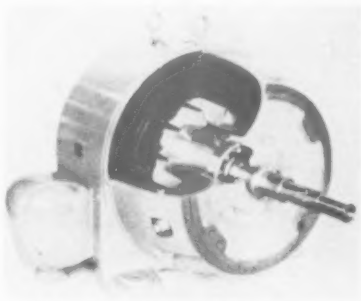


High-capacity thrust bearing features staggered slotting

heavy-duty applications on extruders, generators and pulverizers. The retainer design sets long roller slots of five rollers each in alternate positions with short roller slots of four rollers each which increases the number of rollers exposed to the bearing's thrust load, thus providing a 590,000-lb. capacity load at 100 r.p.m. The retainer is constructed of centrifugally-cast bronze.

## Close-Coupled Pump Motor

U. S. ELECTRICAL MOTORS, INC., Box 2058, Terminal Annex, Los Angeles 54, Calif., has announced the type "SCB" 60-hp., close-coupled pump motor. Designed specifically for use with centrifugal pumps, the motor supports the pump on a NEMA style "C" registered mounting bracket to eliminate shaft alignment or pump mounting problems. A step shaft, with a special diameter, shoulder and tapped hole for mounting the impeller, has ground diameters for precision assembly and sealing against leakage.



Motor for use with centrifugal pumps

Grease-lubricated ball bearings permit vertical, horizontal or intermediate angle intallations. Additional features include asbestos-protected windings, Lubriflush lubrication of bearings, and normalized castings in the assembly.

## Small Capacity Cranes

QUICK-WAY TRUCK SHOVEL CO., 4152 Josephine St., Denver, Colo., has introduced a line of small capacity, truck mounted equipment, Model L-2 of $\frac{1}{2}$-cu. yd. capacity and a 10-ton crane; E-2, with 4/10-cu. yd. capacity and 7$\frac{1}{2}$-ton crane; the S-2 with a capacity of $\frac{1}{3}$ cu. yd. and a 5-ton crane; and the J-2 of $\frac{1}{4}$-cu. yd. capacity and 3$\frac{1}{2}$-ton crane. The models stress convertibility with five booms, to crane, shovel, trench hoe, front dump shovel and scoop. Special attachments available include the hammer drive clam, dragline, clamshell, magnet, pile driver, hay fork, log grapple, back filler blade, telescoping boom and skull cracker.

Models L-2 and E-2 feature an all-steel, full vision cab with safety glass, and clutches of the "roll-in," self-energizing, reversible shoe type. Oil-tight pans encase all engine, jack shaft and main hoist drive gears. The control cabinet features independent, self filling hydraulic cylinders on each control line, and only a slight pressure on the operating level is required to transmit full power to the clutch due to increased leverages in the hydraulic application. Fully machined side frames with diagonal bracing are said to insure permanent alignment of drum shafts and gears.

Models S-2 and J-2 have clutches with increased fulcrum leverage to insure easy energizing clutch action with less effort to the operator.

Model L-2 of $\frac{1}{2}$-cu. yd. capacity and 10-ton as a crane

# PRODUCING POZZOLAN and LIGHTWEIGHT

Looking down at one of the processing plants where pozzolanic material and concrete aggregate are prepared

IN AN AREA roughly 200 miles north of Los Angeles and near the coast is a large and unique deposit of oil-impregnated diatomaceous earth. The deposit, containing an estimated 82,000,000 tons of readily available material, is controlled by the Airox Co. of Los Angeles, Calif.

This so-called "oil-rock" is the raw material from which the company produces a variety of materials: including an exceedingly active pozzolan; an artificial, lightweight, color concrete aggregate; colored roofing and landscaping granules; and roadbase. All products have found ready acceptance in the areas of central and southern California, and pozzolan has been shipped as far as Arizona and Nevada for use in the concrete of several large structures.

The Airox Co. regards pozzolan as its primary product, principally due to the increasing importance and use of this material throughout California. Pozzolans have a long and distinguished history dating from the Roman era, when excellent hydraulic cements were produced from the combination of pozzolanic materials and lime.

Today, pozzolans, defined as siliceous materials which, although not cementitious in themselves, will combine with lime and water to produce cementitious compounds, are being used throughout the country to produce better concrete at lower cost. Pozzolans are particularly useful in the areas served by the Airox Co. as a corrective for harmful alkali reactions occurring in concrete, for many counties in California are known to have deposits with deleteriously reactive materials.

The pozzolan produced by the Airox Co. has been used on numerous U.S. Bureau of Reclamation projects, including Davis Dam in Nevada, Tecolote Tunnel and Cachuma Dam in California. Other users of Airox pozzolan include the Pacific Gas and Electric Company and the Southern California Edison Company—the former in its new steam plant at Morro Bay and the latter in its Big Creek No. 4 Dam, both in California.

Diatomaceous earth is a whitish, porous, lightweight material, and is composed essentially of the skeletons of diatoms. These minute organisms lived both in salt and fresh water. On dying their siliceous skeletons were deposited by the billions to form enormous deposits. The material is usually high in amorphous silica, and is therefore regarded as opaline in character. Opalite itself is quite active chemically as a pozzolan, but by calcining to temperatures in the 1500 to 1800 deg. F. range, the chemical activity is increased and the water requirement is lowered.

Frederick W. Drury, Jr., left, chief engineer, and Norman Moir, plant superintendent at Shuman, Calif.

## Mining Method

At the Airox property at Shuman, Calif. (10 miles southwest of Santa Maria), the oil-impregnated diatomaceous earth is mined with a Caterpillar D-7 equipped with ripper and dozer. The raw material is blended on the bed of the quarry with caprock (leached oil-impregnated diatomite), and is dozed, or hauled in a Caterpillar Carryall to a grizzly that feeds the preliminary processing plant by gravity. The dark-colored rock is relatively easy to handle in the plant where it is reduced to two gradings by means of Jeffrey crushers, one single and one double roll unit with means for recirculation. Crushed raw material is graded to 1 in. and 2¼ in. top size and $\frac{3}{16}$ in. bottom size by Symons screens.

## Open Air Calcination

A novel feature of the operation is the method of calcining the "oil-rock." Calcining is accomplished in open burning beds on level areas adjacent to the final screening plant. The beds, built up in windrows, are ignited by simply throwing on a few shovels full of live coals from other beds that are already burning. The oil in the material, ranging in content from 20 to 40 gal. per ton, is sufficient to provide for the entire fuel requirement. The bedded material burns from 10 to 20 days, the rate of burning and maximum temperature being governed by the grading of the rock and the methods of bedding.

For production of lightweight colored aggregate, the burning time averages 10 to 14 days, and the rock is sized from $\frac{3}{16}$ in. to 2¼ in. Fines would clog the beds and are rejected

Close-up of one of the beds of burning material

# AGGREGATE

**The Airox Co., Los Angeles, Calif., produces a very active pozzolan for concrete admix purposes; a lightweight, colored aggregate; and roofing and landscaping granules from open-air calcining of an oil-impregnated diatomaceous earth**

By WALTER B. LENHART

The oil-impregnated diatomaceous earth is bulldozed or transported by haulage units to a hopper from which a chute takes the material to the plant where it is crushed and sized before burning in open beds

at the primary crushing plant. Burning temperature of the larger grading of "oil-rock" averages 1800 deg. F. For production of pozzolan, the burning time averages 18 to 20 days, and the rock is sized from $\frac{3}{16}$ in. to 1 in. Burning temperature averages 1550 deg. F.

After burning some carbonized rock is deposited as a thin outer coating on the piles and is carefully skimmed off by hand and discarded. Below this top layer, the calcined rock is a pleasing buff color.

## Crushing, Screening and Grinding Operations

The calcined material is then loaded into Ford dump trucks by a Hough TD-9 skiploader, and is carried to an area directly over a reclaiming tunnel from which it is moved by belt conveyor to the final crushing, screening and fine grinding plant.

Dusting in the reclaim tunnel is held to a minimum by means of an effective exhaust system driven by a 7 hp. motor.

Two finish sizes of lightweight colored aggregate are made; a minus $\frac{3}{16}$-in. sand, and a plus $\frac{3}{16}$-in. to $\frac{5}{8}$-in. rock with reduction accomplished in a hammer mill. Due to the special problems of operation with the calcined "oil-rock," the engineering force of the Airox Co. designed and built the hammer mill presently in use. Hammers are changed weekly. The hammer mill operates in a closed circuit with a double-deck vibrating screen, operated dry. Occasional custom gradings other than the two mentioned can be produced by changing these screens and eliminating recirculation.

For the pozzolan, the 1-in. top size calcined "oil-rock" is reduced in the hammer mill to the same sizes as the lightweight colored aggregate. The $\frac{3}{16}$-in. to $\frac{5}{8}$-in. rock is fed either to a special storage bin for roofing granules, or is recirculated for further reduction to sand. All sand is fed to a mill feed bin which supplies a 6- x 16-ft. Allis-Chalmers ball mill for reduction to ultimate requirements.

Airox pozzolan is manufactured to meet the U.S. Bureau of reclamation specifications for "pozzolan other than fly-ash." They require that 88 percent must pass a No. 325 mesh screen under wet screening conditions. Other requirements of these specifications include satisfactory physical and chemical tests. To insure that the pozzolan continues to meet specifications, the Airox Co. maintains a specific surface of 10,000 to 12,000 sq. cm./gm. as determined by the Blaine air-permeability fineness tester. This is a fineness approximately four times that of Type I portland cement. The pozzolan is bagged on a two-tube St. Regis packer, using multiwall paper bags holding one cubic foot, or 47 lb. each of the material.

Because many shipments of the pozzolan are in bulk, the pozzolan is also stored in a 150 ton bulk silo used to load out hopper-bottom truck and trailer rigs. Bulk pozzolan is occasionally shipped by rail as required.

## Finished Product

The chemical composition of the pozzolan and the lightweight aggregate is as follows:

| | |
|---|---|
| $SiO_2$ | 70 percent |
| $Fe_2O_3$ | 5 percent |
| $Al_2O_3$ | 14 percent |
| CaO | 3 percent |
| MgO | 2 percent |
| $Na_2O$ | 2 percent |
| $K_2O$ | 1 percent |
| $SO_4$ | 0.5 percent |
| Ignition Loss | 2.0 percent |

The lightweight colored aggregate

*(Continued on page 96)*

Calcining of oil-impregnated diatomaceous earth is done by burning in open beds. Final processing plant can be seen in background

# INSTRUMENT CONTROL In Phosphate Processing

## International Minerals and Chemical Corp., Bartow, Fla., uses many automatic control instruments in its beneficiation of phosphate matrix in the Noralyn plant

By DAVE ANDERSON*

PHOSPHATE ROCK PROCESSING at the Noralyn plant of International Minerals and Chemical Corp., Bartow, Fla., is typical of beneficiation operations extending to a variety of ores, including taconite and other iron deposits. The latest automatic control techniques are harnessed to transform a low grade, (mined) raw material into a high grade phosphate concentrate. Phosphate rock, incidentally, is principally used as plant and animal food although other uses include pharmaceuticals, matches, polishing agents, beverages, plasticizers and detergents.

Inasmuch as an increasing number of ores are being found in a low grade state—either in physical or chemical combination with other (and possibly undesirable) materials—some sort of processing is ordinarily required. It may be as simple as washing or sorting. On the other hand, it may involve complex operations calling for mechanical, electrical or chemical treatment, agglomeration, or other expensive operations. Most of these operations, though basically beneficiation processes, are more specifically concentration, since the resulting product is merely a concentrate of the original ore. The requirements for beneficiation vary widely with the material involved, its analysis and the requirements for the beneficiated product.

In the case of phosphates, where about 75 percent of the product goes into commercial fertilizer—to be spread, sometimes as much as 1000 lb. to the acre, to rebuild "farmed out" soil—beneficiation is largely a matter of concentration. However, further treatment is necessary to insure quick availability to the plants.

### Mining Operations

Mining operations at Noralyn require the removal of overburden ranging from 10 to 20 ft. above the phosphate ore body, which is technically known as the "matrix." The matrix ranges from 5 to 20 ft. in depth, depending upon its location. Both the overburden and the matrix are removed by large dragline excavators which can handle 25,000 or more tons of material each 24-hr. period. (see ROCK PRODUCTS, June, 1948, page 116).

As the matrix is excavated, it is dumped by the dragline into a pit or "well" where hydraulic monitors play water upon it under pressure. The resulting slurry moves through large electrically driven centrifugal pumps and steel pipe to the washing plant some distance away. The larger particles (plus 14 mesh) are recovered by washing and screening and are called "pebble phosphate rock." The use of the flotation process has resulted in recoveries of up to 95 percent of the phosphate in the ore coming into the plant. One of the results of the use of such improved methods has been to add greatly to the life of the ore reserves.

The remaining portion of the matrix, after the pebble has been removed in the washer, goes to a 175-ft. hydroseparator, where the fine portion (minus 200 mesh) is washed out. One operator in the field uses a "hydrocyclone" in place of a hydro-separator for this step.

The underflow from the hydro-separator is pumped to the sizing section, where it is split into two fractions; minus 14 plus 35 mesh and minus 35 plus 200 mesh.

The coarser fraction of the feed is treated in Humphrey spirals. These units are fed at the top with a reagentized slurry of ore and water. As the material flows down the spiral, the phosphate, being coated with reagents, goes to the outside of the circle, while the sand stays on the inside and is drawn off through portholes.

The finer fraction of the feed is treated in the flotation section of the plant, where it is reagentized in a similar manner as in the spiral section and fed in a slurry to the flotation cells. These cells are rectangular tanks containing paddles, which in ad-

Fig. 6: Dave Anderson, instrument supervisor, checking status of a part in the files

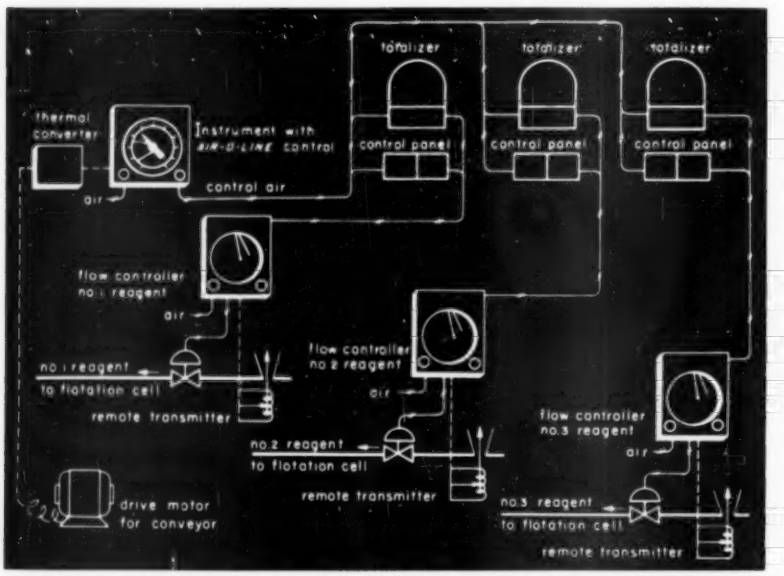



Fig. 1: Schematic diagram of control system to synchronize flow of three reagents to flotation cell with load of phosphate on conveyor

*Supervisor, Instrument Dept., Noralyn Plant, International Minerals and Chemical Corp., Bartow, Fla.

dition to agitating the pulp also introduce air. The phosphate particles being coated with reagents are attached to the air bubbles and, on coming to the surface, are removed as a froth. This concentrate is then treated with a small quantity of sulphuric acid which removes the primary reagents.

After the acid washing step, the material is again treated in flotation cells. This step is a reverse of the first flotation treatment, inasmuch as the silica sand is floated out while the phosphate rock is left behind. The tailings or non-floated portion of this step is the final flotation concentrate.

The spiral and flotation concentrates are stored in separate bins from which they are transferred to wet storage prior to drying and further treatment. The tailings which consist primarily of silica sand, are pumped to waste.

## Automatic Controls

The addition of reagents to the flotation cell is controlled automatically by the three flow controllers designed by the Minneapolis-Honeywell, Industrial Division (Fig. 3). The set points of these three controllers are positioned by a fourth controller—an electronic instrument with Air-O-Line control—connected to a thermal converter on the conveyor belt motor. A thermal converter is a device that measures the heat generated by a portion of the power used by the drive motor, and since this heat is proportional to the power, accurately measures the motor load. As the load of fine, wet phosphate on the conveyor belt increases, the ElectroniK instrument repositions the set points of the flow controllers to increase the flow of reagents to the flotation cells in proper proportion. Should the phosphate on the conveyor decrease, the system would cut down proportionately on the amounts of the three reagents, to the flotation cells. The system is shown in the schematic diagram, Fig. 1.

Also at the flotation cell stage, instruments control specific gravity, flow and pH. As shown in Fig. 2, a sample of wet phosphate flows from the flotation cell into a cone with an overflow pipe. The heavy slurry runs off through the apex of the cone, and a lighter, more liquid portion of this sample is drawn off at the top of the cone through the overflow pipe and past a pH electrode. The pH signal is amplified and passed to another electronic instrument with Air-O-Line control which, in turn, repositions the set point of a flow recorder-controller to position a diaphragm motor valve in the caustic feed line. Thus, pH is maintained within very close limits.

After flotation, the phosphate has reached a high degree of freedom from impurity, and is ready for drying in large, rotating calciners. Here instruments record and control exhaust gas temperature and rock temperature, and one three-pen recorder measures burner variables such as

Fig. 4: Flotation cells where sand and other foreign matter is removed from slurry. Paddles agitate mixture continuously

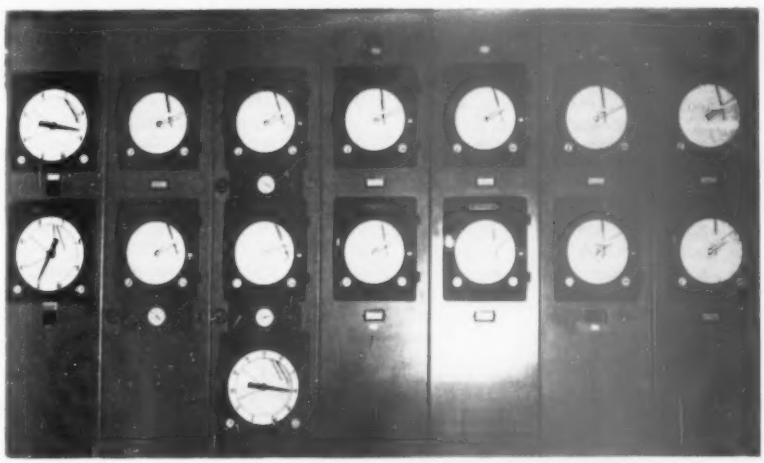


Fig. 3: Portion of instrument panel showing electronic recorder controllers and flow meters that match flow of reagents to flow of phosphate rock to flotation cells

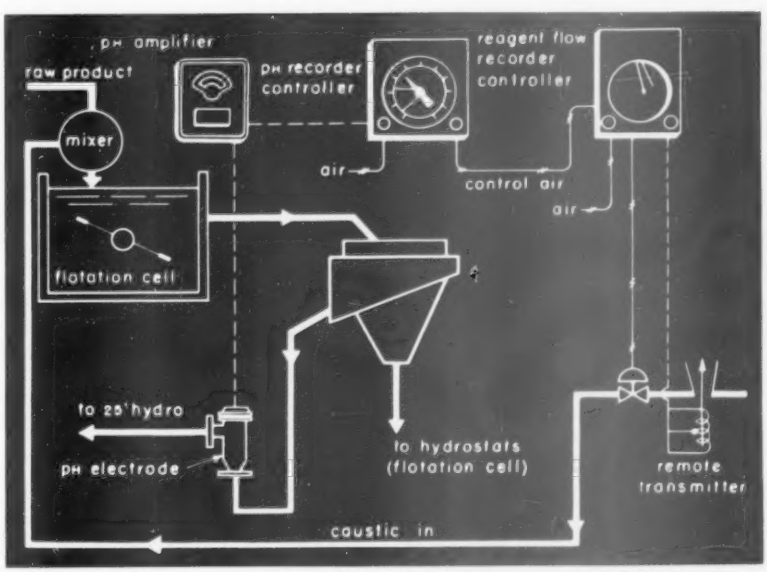



Fig. 2: Schematic diagram of pH control system for addition of caustic to flotation process

**Fig. 5: Large, well-lighted, instrument maintenance shop responsible for servicing 800 instruments of many types**

pressure, g.p.m. flow of oil, and temperature. These instruments assure close adherence to product specifications in the drying process.

The 10-man instrument department at the Bartow operation keeps approximately 800 instruments in top notch working order, as well as servicing two-way radios which the company uses for communication between the far-flung phases of this gigantic operation. Three of these men are specialists—an electronic man, a flow man and a WeightOmeter man. The rest are "all-around" instrument men. The instruments serviced comprise potentiometers, flow meters, thermometers, etc. As many as 100 controllers may be working in one plant alone, so it can readly be seen that an efficient instrument maintenance department is a must.

All instruments costing in excess of $50 are tagged with a number and kept in inventory. The record of all instruments in this category contains information as to type, serial number, name plate data and so on. In addition to these instrument records, a file is maintained covering all instrument parts on hand, for ready reference as to what is in stock at all times.

A high degree of efficiency is essential if enormous quantities of raw materials are to be processed economically and profitably.

## Asbestos Booklet

SECRETARIAL SERVICE, publisher of *Asbestos*, recently announced the availability of its third edition of "The Asbestos Factbook." The booklet contains, in compact form, facts about the origin, location of deposits, uses, analyses, grades and qualities of asbestos, as well as information concerning varieties, discovery and early manufacturing of asbestos. This 20-page booklet, which is recommended for reference purposes, is available at 25 cents per copy from Secretarial Service, 808 Western Saving Fund Bldg., Philadelphia 7, Penn.

## Slag-Gypsum Cement

G. MUSSGNUG has been producing a small tonnage of slag-gypsum cement since the war and gradually gaining experience in its manufacture and behavior in the field.

So far there has been no completely acid-resistant hydraulic cement available. In aluminous cement and in "Hochofenzement" (blast furnace cement high in slag) better resistance is found to aggressive solutions than in portland cement products, while the new slag-gypsum cement goes a step farther.

H. Kühl discovered this new cement in 1908, but little attention was attracted to it for some time and then the French and Belgians began to make it some 30 years ago. Their experience in contact with sea and other aggressive water has been excellent. Since it requires a slag of proper high-alumina content, it had not been produced in Germany until recently. The chief constituents of the slag are: $SiO_2$, about 25 percent; $Al_2O_3$, 13 to 15 percent; and CaO, 43 to 45 percent. Then 80 to 85 parts of this slag are ground with 15 parts of anhydrite and 1 to 3 parts of portland clinker.

Setting times and soundness tests are always satisfactory. The strengths run very high, comparing favorably with the best Type III portlands. Best strengths are obtained with plastic consistencies at 6½ to 7 gal. per bag, a distinction from portland cement. Expansion in water is somewhat higher than for portland. On the other hand, shrinkage is appreciably lower. These properties are regarded as highly significant in concrete applications. The heat developed is very low, something like 1/7 of that from portland cement.

It is suggested that the hardening process involves the formation of calcium sulfoaluminate, in view of the prominent role of the alumina in the slag in securing the desired results.

For laboratory tests on resistance to aggressive solutions, concrete prisms 7 x 7 x 14 cm. were prepared with a cement factor of about 6 bags per cu. yd. The cements included: Portland cement; a 40/60 slag cement; one very low in portland clinker; a slag-gypsum cement; a tras (30/70) cement; and an aluminous cement. The slag-gypsum cement prism made a showing comparing very favorably with all the others. A solution of 5 percent $MgSO_4$ was found to be most harmful. All prisms stored partly in 5 percent sodium sulfate solution suffered efflorescent disintegration of the upper portion of the prisms extending out of the solution. (*Zement-Kalk-Gips*, Vol. 4, p. 1, 1951.)

## Pozzolanic Materials

*(Continued from page 93)*

is angular, tough, and suitable for use in monolithic concrete or concrete products. It has an absorption of 27 percent by weight, and an average weight of 42 lb. per cubic foot.

The pozzolan is buff-colored, very finely ground, and is not affected by the presence of moisture. It has no absorption, weighs 47 lb. per cubic foot, and has a specific gravity of 2.48.

The Airox Co. recommends the pozzolan be used in concrete as a partial replacement of portland cement, the percentage replacement varying according to qualities desired in the fresh and hardened concrete. For control of alkali-aggregate reaction, a 20 percent substitution by weight of portland cement is recommended. Other requirements vary the percentage substitution from 10 percent to 25 percent. The pozzolan is known to eliminate leaching, increase watertightness, help prevent segregation, improve workability, and lower the heat of hydration. Pozzolan is considered to be more effective in the leaner mixes.

E. M. Markell is president of the Airox Co., Allen West is superintendent, and Frederick W. Drury, Jr., is chief engineer. Dr. Raymond E. Davis has been active as a consultant to the Airox Co. on pozzolanic problems.

## Crushed Stone Operations

ARKOLA SAND AND GRAVEL CO., Fort Smith, Ark., is operating at its recently completed crushed stone plant at Hatton, Ark. The plant is located on a mountainside, utilizing trucks to transport stone from the quarry to the crushing plant. Other facilities include a truck loading ramp, railroad siding, conveyor belt systems and crushing and washing equipment. Early production amounted to approximately 1000 to 1200 cu. yd. of crushed stone daily, with an increase predicted. Mack Shaver is in charge of operations.

## Fluorspar

SEYMOUR MINING CORP., Salida, Colo., is contemplating a plant to process 1000 tons of fluorspar daily.

## Of What Value Are

# Coarse Particles In Agstone?

### Purdue University comparative studies indicate coarse fractions have an equal economic value

By RALPH E. SIMPSON*

CURRENT DISCUSSIONS of the relative merits of coarse and fine agricultural limestone are often accompanied by test data comparing results of the use of naturally graded screenings and limestone dusts that pass a 50 or 100 mesh screen. Ever since the Indiana Farm Bureau published an article by Soil Conservationist Milford Richman claiming that farmers "get very little benefit from the coarse fraction of limestone," we have been searching for reports of experiments which involved liming with this "coarse fraction." Recently we have found data on tests made by Purdue University agronomists and reported in their Bulletin No. 329 which include applications of "calcium" limestones that contain no fines—only one percent passed a 20 mesh screen although 100 percent passed a No. 4 (Item 6 Table 1 and Item 5 Table 2).

These field tests were made almost simultaneously at two experimental farms located in widely separated parts of the state, one the Pinney-Purdue field in northwestern Indiana near Laporte in Newton fine sandy loam, a dark brown prairie soil; the other the Jennings County field in southeastern Indiana near North Vernon in Clermont silt loam, an ashy gray timber soil. Both soils are described as "widely represented in their respective areas" which include a major portion of Indiana farm lands.

Average crop yields, value of crop increases, cost of material applied and net returns for the Pinney-Purdue tests are reported in Table III which indicates that this coarse fraction (4-10) calcium limestone used there was applied at the rate of four tons per acre on Plot No. 13. Fortunately we also find that 4 mesh (naturally graded) calcium limestone dust was applied on Plot No. 15 at this same rate of 4 tons per acre so if minor differences in acid neutralizing values are ignored, the only variable is the relative fineness. Also, fortunately, results were reported in terms of crop behavior, the basis most useful to farmers.

### Test Plot Results

Applications were made in 1920 (see note Table V) so the results reported are after seven years of three-year rotation cultivation. Reported *average* yields per acre of corn are as follows (From Table III):

| | | |
|---|---|---|
| Plot No. 12 | (4 mesh-screenings) | 28.9 bu. |
| Plot No. 13 | (4-10 mesh—coarse) | 29.0 bu. |
| Plot No. 14 | (no lime check) | 12.6 bu. |
| Plot No. 15 | (50 mesh—fine) | 30.4 bu. |

These results would indicate that for corn growing on Newton loam, this coarse fraction was equally as effective as screenings and only about 8 percent less effective than 50 mesh dust.

The Jennings County data are in Table IV. There this coarse fraction, (4-10) calcium limestone, was applied at the rate of three tons per acre on Plot No. 13. This same rate of application was used on Plot No. 12 where 4 mesh screenings were applied and on Plot No. 21 where the application was 50 mesh dust. Reported results are also after seven years of cultivation. The reported *average* yields of corn are as follows (From Table IV):

| | | |
|---|---|---|
| Plot No. 12 | (4 mesh-screenings) | 56.1 bu. |
| Plot No. 13 | (4-10 mesh—coarse) | 52.0 bu. |
| Plot No. 14 | (no lime check) | 46.2 bu. |
| Plot No. 21 | (50 mesh—fine) | 51.4 bu. |

Here the coarse fraction was 11 percent more effective than the 50 mesh dust, but the naturally graded screenings were far more effective than either the coarse or fine fraction, indeed almost twice as effective as the 50 mesh dust for improving corn growing in Clermont loam.

From these data, one must conclude that the coarse fraction is as good or better than the fine fraction for corn growing in Indiana but screenings containing all fractions are best.

### Economic Comparisons

Although corn is the most profitable Indiana crop (almost two-thirds of the total value of crop increases reported from tests at both farms accrue from increased corn production), a good rotation must include small grains and hay. Here again comparisons reported *do not show that farmers get very little benefit* from the coarse fraction. If the same detailed analysis is made of the tests on oats at Pinney-Purdue, it can be shown that while the fine fraction was about 30 percent more effective than the coarse, the screenings were about 45 percent better. On wheat at North Vernon, the fine fraction was about 25 percent more effective and the screenings 55 percent better. Reported crop increases in small grain crops are modest compared to corn.

For the hay crops, reported crop increases are widely variable. At Pinney-Purdue, the 50 mesh fine dust was much more effective than the coarse fraction—almost 2½ times better but at North Vernon the coarse fraction produced more than 30 percent additional hay than did the fine dust. Screenings ran second at Pinney-Purdue being about twice as effective as the coarse fraction but at North Vernon they showed only 40 percent better results.

The value of these minor crops are given true weight in the dollars-and-cents studies of costs and returns included in these same tables.

At Pinney-Purdue:

Plot No. 12. For a $12 investment in 4 mesh calcium limestone (screenings) the total net returns were $35.52, a profit of 296 percent;

Plot No. 13. For a $10 investment in 4-10 mesh calcium limestone (coarse fraction) the total net returns were $29.52, a profit of 295 percent;

Plot No. 15. For an $18 investment in 50 mesh calcium limestone (fine fraction), the total net returns were $41.52, a profit of 231 percent.

At North Vernon:

Plot No. 12. For a $9 investment in 4 mesh calcium limestone (screenings) the total net returns were $36.34, a profit of 404 percent;

Plot No. 13. For a $7.50 investment in 4-10 mesh calcium limestone (coarse fraction), the total net returns were $23.79, a profit of 317 percent;

Plot No. 21. For a $13.50 investment in 50 mesh calcium limestone (fine fraction), the total net returns were $38.51, a profit of 285 percent.

Apparently the present day search for an "essence" of limestone which it is hoped will produce immediate results like nitrogen-supplying fertilizers may be futile. Farmers often realize the major return in the year in which many fertilizers are applied, and shortsighted expedient exploiters

(Continued on page 144)

*Engineer-Director, Indiana Mineral Aggregates Association

# Ideal Cement Co's. Research Center

Modern architectural design employed in laboratory buildings of new research center

RESEARCH IN MODERN INDUSTRY is just as essential to its success as adequate buildings, the machinery they house, and the skilled men with the know-how to produce the manufactured article. Many small organizations do not allocate separate funds for this purpose. Nevertheless, probably most of them avail themselves of developments which result from this type of experimentation, by keeping up with related current scientific literature and various articles of interest in the trade journals. Others keep abreast of new developments by setting up a cooperative system whereby this essential work is carried on by a selected centralized group of scientists and where the results of the experimentations are then made known to the subscribers.

The Portland Cement Association performs this function for the contributing membership, comprising most of the cement-producing units in the United States. This very excellent group of scientists in the splendidly appointed new laboratories in Skokie, Ill., and the P.C.A. Fellowship at the National Bureau of Standards in Washington, D.C., provided with the latest equipment designed to help them uncover factual data, are dedicated to the purpose of finding out all there is to be known about portland cement, so that the manufacturer with such information at hand can then produce superlative products. Furthermore, the P.C.A. places equal emphasis on the use of cements in the various construction fields, so that full advantage may be derived from the base products in the form of utility and long service of resulting concrete and mortar structures.

The research conducted by the P.C.A. must therefore proceed along fundamental lines, where the experimental efforts are broadly limited only to matters of general interest to all of the member companies. This situation unfortunately leaves many problems unanswered which arise in the course of normal operations at any one mill, details with which the P.C.A. cannot possibly cope. Such matters are of necessity then left in the hands of the individual mill personnel for solution of the problem under study.

The new Ideal Research Center, built at a cost of approximately $500,000, including building and equipment, was constructed with this general thought in mind—however, constantly keeping in the foreground the ultimate goal of improving the quality of the company's products through continued research, even of the basic type, where ever lack of pertinent data, published or otherwise, dictate the wisdom of such action to achieve this end. The parent manufacturing organization consists of 13 operating units spread diagonally across the

**Costing approximately $500,000, the new research center of Ideal Cement Co., near the Boettcher, Colo. plant, will serve 13 plants with research studies applied to production techniques and cement uses**

By G. C. WILSNACK*

country from Alabama to Oregon, and to solve their problems most effectively, it was considered both economical and efficient that the answers be supplied for all of them by one centrally located Research Department. Such an arrangement has its obvious advantages, since the same highly trained personnel and laboratory facilities are thus made available on an equal basis for all units.

Many advantages accrue from other highly specialized lines of effort undertaken by this department. For example, a very complete technical library with available current scientific literature, even though in some instances only remotely connected with the cement business, and trained personnel assigned to study the texts, makes available to the entire Ideal Cement organization the most recent developments of industrial and scientific progress. Means are therefore at hand to constantly improve the manufactured products, provided further experimentation and research prove the value of these new ideas.

*Director of Research, Ideal Cement Co.

Harry Tilloson, research chemist, separates material for component analysis in a high-speed centrifuge

A 17 in. by 12-ft. kiln and a 3- x 30-ft. kiln, fully equipped with automatic controls and recording instruments, form the nucleus of a complete pilot plant

## Pilot Plant Kilns

The pilot plant provides the proving ground for trying out these new schemes on a semi-commercial scale. Two fully equipped kilns, one 3 x 30 ft., and a smaller one 8 in. x 12 ft., produce lightweight aggregate from shales and clays under investigation, or experimental lots of clinker from natural raw materials concerning which information is desired. The large unit, completely equipped with control and recording instruments, can be fired at any desired temperature and automatically stabilized at that point without further attention by the operator. Draft control follows a similar pattern, and so does the feed mechanism. Interior kiln temperatures are recorded every 2 to 4 ft. throughout practically the entire length, and any selected temperature can then be maintained constant for the complete run by means of this control system. The smaller of the two kilns is used for preliminary studies, since the effect of heat on the properties of smaller batches of unknown materials can thus be quickly determined, and the need for a larger run in the bigger equipment established.

## Raw and Finished Material Processing

One large room in the service building, which is entirely separate from the main group of laboratories, houses all the machinery required to process the various feeds demanded by the two kilns. Herein are located crushing rolls, a jaw crusher, hammermill, two power-driven large-capacity screens of various mesh sizes, and a very complete closed circuit grinding unit. This latter machine, operating in adjustable closed circuit, can pulverize to any desired fineness, different types of feed up to ½-in. diameter, and produce a finished product in sufficient quantity to supply material for extensive laboratory investigations.

Aside from experimentation with shales and clays used in the manufacture of lightweight aggregates, this system can be put to many other uses. For example, the effect of kiln feed composition and fineness can be studied in relation to the required burning zone temperatures for the manufacture of quality cements. Furthermore, the ground clinker produced by such closed circuit grinding, closely approaches the size distribution in the finished cement obtained in large commercial grinding units. This is an essential requisite for any cement testing program.

Having thus obtained a sufficient amount of the base material for study, it is of interest to follow the experimental progress throughout the various departments, giving for each a brief description of the apparatus it contains and the part it plays in the solution of the problem at hand.

## Chemical Laboratory

A completely equipped chemical laboratory, of ample size to comfortably accommodate six chemists, pro-

Robert F. Blanks, research consultant for Ideal Cement Co. addressing crowd of more than 500 industrial, professional and business leaders who attended dedication of research center. Some of the officials and prominent guests identified at the speakers table are, left to right: M. O. Matthews, executive vice-president; Chris Dobbins, president; Robert Stearns, president of Boettcher Foundation; Robert F. Blanks, speaker; J. H. Colton, member, board of directors; G. C. Wilsnack, research director; and Dr. Allan Bates, vice-president, Portland Cement Association

vides the means for complete chemical analyses of all materials related to cement manufacture. Since cement production is intimately associated with the use of fuel, this department is also equipped to establish the value and other necessary facts concerning the different types. A flame photometer is also available to obtain the necessary laboratory data for studies in connection with producing low alkali cements.

A spacious physical or special laboratory contains apparatus essential to many types of investigations not directly connected with actual chemical work. For instance, in this department are located a complete petrographic outfit composed of a Leitz petrographic microscope and microphotographic equipment for the study of polished sections of clinkers which have been subjected to variable heat treatments, etc. Any fundamental study involving cement properties requires such examination in order to uncover many of the basic underlying facts.

In most instances the average chemical composition of portland cements, calculated to the usual compounds in accordance with the Bogue method, only partially reveals the characteristics of the product. Therefore with the aid of a very efficient centrifuge, powdered materials such as portland cements in non-reactive liquid suspensions can be quantitatively isolated into the different size fractions for further study. This same apparatus, by the use of selected specific gravity liquids, also permits broad separations of the component parts of specimens composed of mixtures of materials of different densities. For example it is possible to separate the extremely fine (0-2) micron fraction in any cement and produce enough of this material for microscopic study, also by X-ray diffraction techniques, and for chemical analyses. Such a systematic investigation therefore provides the means of determining in a very precise manner the details of the pulverized cement with respect to both physical and chemical characteristics, throughout the entire fineness range.

The X-ray diffraction apparatus lends itself to a variety of applications in the solution of the many complex problems with which this department is confronted. The film patterns obtained by this apparatus are properly analyzed in accordance with prescribed procedures of measurements and compared with data appearing on a card index system, which then permits identification on a qualitative and partial quantitative basis of practically all types of crystalline compounds. In conjunction with the chemical and physical properties of the size fractions, this equipment then reveals vitally important information difficult of attainment by other methods.

This special laboratory also contains a differential thermal apparatus, a very versatile piece of equipment which, when properly used, reveals much significant information. Primarily it is used to study thermal reactions which occur when a substance is subjected to increasing temperatures. A change in the chemical or physical state of a material under such treatment results in either an exothermic or endothermic reaction, and the apparatus is so designed as to very accurately measure the extent of these temperature changes and at what point on the temperature scale they occur, thus providing vital data concerning its behavior during any commercial heating cycle. By such a technique much light is also shed on the identification of types of minerals present in a heterogeneous system. It is an invaluable piece of equipment for the study of shales and clays used in the production of lightweight aggregates where bloating temperatures can be definitely determined prior to an actual trial run in the pilot plant kilns. Considerable work remains to be performed with this equipment in the studies of basic materials for the production of portland cements. However, the potential value of the instrument used in connection with cement raw mix studies is practically unlimited.

Continued experimentation of any cement investigation then involves the usual tests prescribed by both A.S.T.M. and federal specifications. The laboratory in which this work is performed is maintained at a constant temperature of 70 deg. F. and a 50 percent relative humidity. Many types of special equipment are located in this room including an originally designed plasticimeter to measure certain phases of this property in masonry and stucco cements. A Vicat type of apparatus of modified construction is used to measure hydration rates of portland cement pastes up to periods of approximately three hours of water contact on the assumption that the degree of stiffening observed is closely related to these reactions. With continued study, this may eventually develop into a very useful piece of equipment revealing vital information on the important subject of hydration rates up to the point

Service building at research center provides transportation of materials and supplies

where the paste becomes rigid. However, much work on this subject remains to be done, including the very important correlation between the observed data and the characteristics.

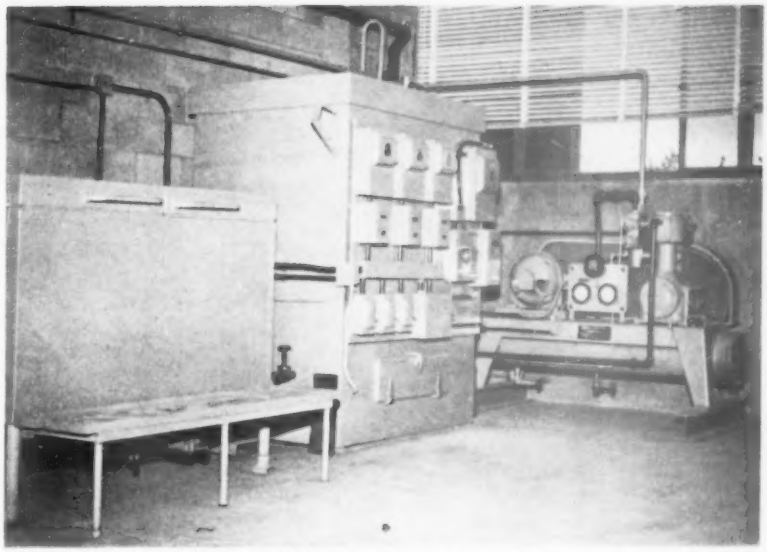
## Masonry and Stucco Cement Studies

The problem of producing masonry and stucco cements is a complex one. There are many properties demanded of such cements during the course of construction and subsequent service. These cements must not only be quite plastic, and thus please the mason, but they must also permit the use of a maximum amount of sand in the mortar consistent with strength, drying shrinkage, water retention, and proper adhesion to the underlying surface. The latter property involves the tensile strength of the plastic mortars, and an apparatus has been designed to measure this characteristic.

## Concrete Laboratory

The concrete laboratory is fully equipped with apparatus to perform all the usual tests with different types of cements and variable aggregates. A ½-cu. yd. drum-type mixer produces the plastic concrete required for molding the different specimens, notably for compression and flexure testing. An automatically controlled fog chamber provides a constant humidity of 100 percent, at a fixed temperature of 70 deg. F., permitting storage of these specimens over prolonged periods of time.

The compression cylinders are then broken by a 300,000-lb. Baldwin compression machine, equipped with an additional weighing cell and low-range indicating dial to accurately measure load applications of a relatively low order, such as for small prisms subject to center-point loading for modulus of rupture. A large three-point loading device gives similar information for the usual 6- x 6- x 30-in. beams. Prior to breaking the 6- x 12-in. concrete cylinders, an apparatus is at hand to measure Young's modulus of elasticity in compression.



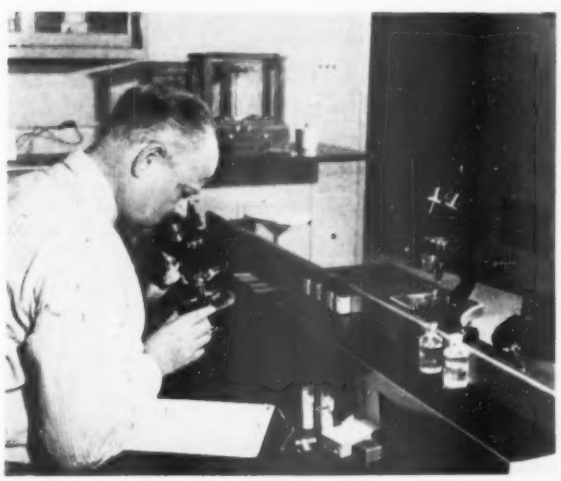
Freezing and thawing equipment at research center

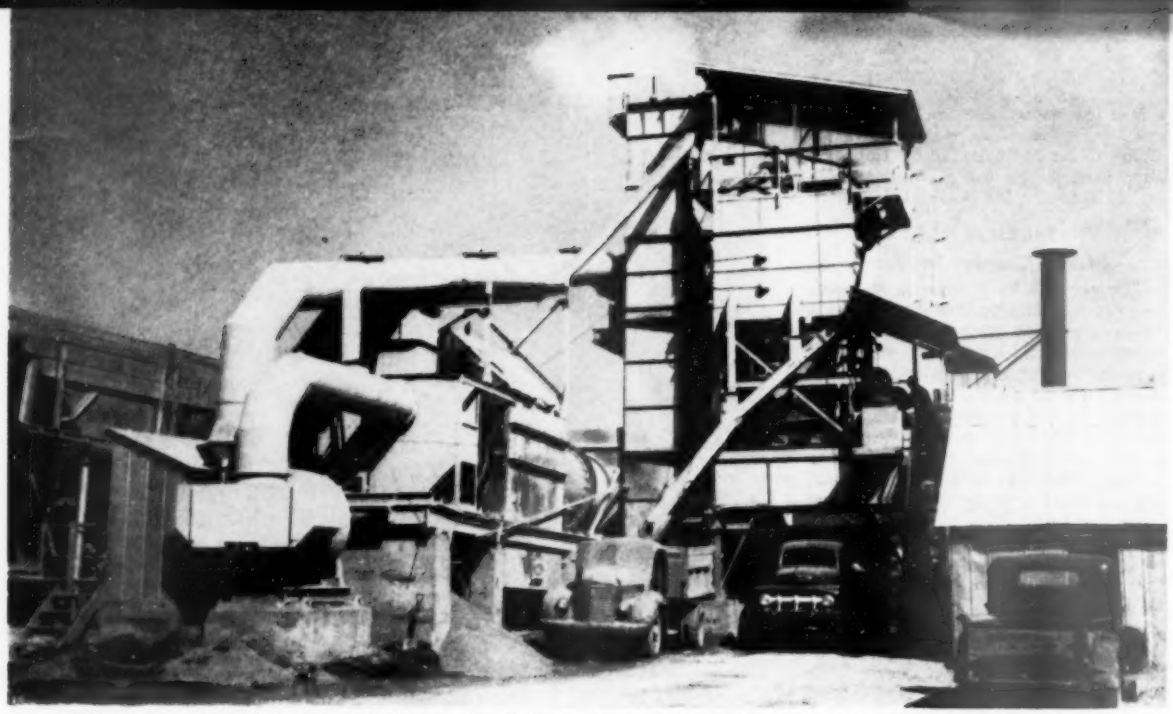
A specially designed freezing and thawing apparatus is available for testing concrete and mortar specimens by alternately subjecting them to temperatures of 10 deg. and 70 deg. F. The flexibility of this equipment is such as to produce any number of cyclic changes up to eight during a 24-hr. period. Alterations within the structure of the hardened mass are then observed by the use of a special device which determines transverse and torsional frequencies of concrete specimens for the purpose of calculat-

(Continued on page 124)

Right: X-ray diffraction equipment being used to study raw materials and finished products

Below: The petrographic microscope, when teamed with analytical chemistry, X-ray diffraction and thermal differential analysis, enables Research Engineer Bill Whitney to establish the constitution of materials and explanation for their behavior under various treatments





Black-top plant operated at quarry which uses a liquid dust precipitator to practically eliminate dust. Stack shows plume of steam

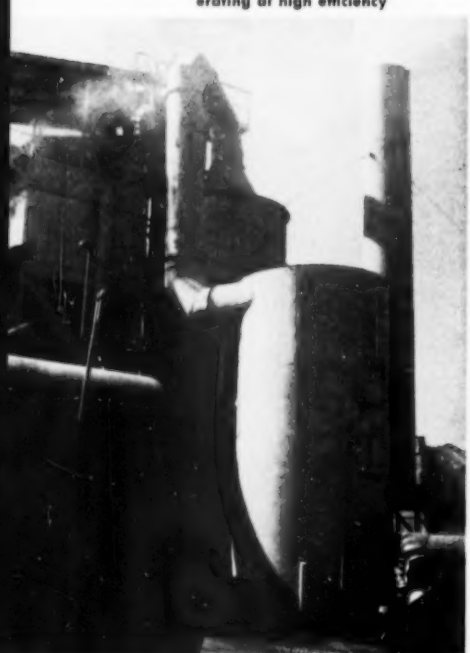
# Making A Stone Plant Dust-Free

**Eastern Rock Products Co., has installed wet-type system of dust control at the Prospect, N.Y., plant. This plant also pioneered in the use of electrically heated screens**

By WALTER B. LENHART

ELECTRICALLY HEATED SCREENS have been used by Eastern Rock Products Co., Utica, N.Y., for about two years to produce minus ⅛-in. plus 20 mesh, and minus 20-mesh material at their Prospect, N.Y., crushed limestone operation north of Utica. (also see ROCK PRODUCTS, March, 1953, page 87) The two heated screens are a 5- x 14-ft. single-deck equipped with ⅛-in. stainless steel cloth, and a 4- x 10-ft. single-deck screen with 20-mesh stainless steel cloth. The top screen is a Tyler unit, and the lower a Tyler Hum-mer screen. W. S. Tyler Co. also supplied the stainless steel cloth. The two screens operate in series with the top screen receiving a feed of minus ¼-in. at the rate of about 55 t.p.h. of which 20 tons is removed as (1-A) or minus ¼-in. plus ⅛-in. material. The 35 tons of throughs pass to the Hum-mer where 20 tons are removed as a plus 20 mesh minus ⅛-in. (1-B) size, with 15 t.p.h. being minus 20 mesh that is sold as agstone and as asphalt filler. The amount of power used ranges from 4 to 7 kw. h. per screen.

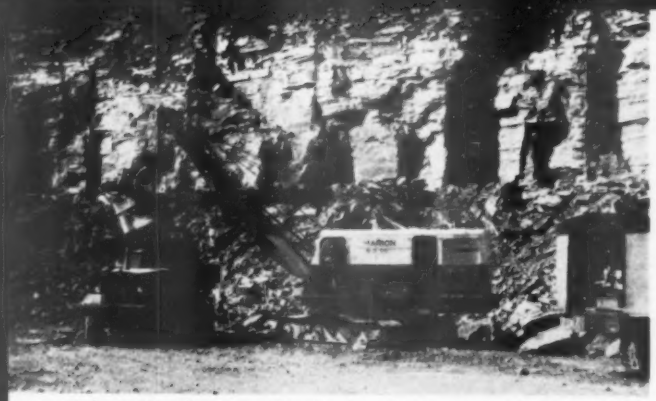
Close-up of liquid precipitator which is operating at high efficiency



These heated screens have worked out very satisfactorily, permitting the plant to operate during wet weather whereas formerly on wet days the plant had to shut down. The screen cloth remains free and open with sharp screen size gradations. During dry days sprays are used at two or more places following the primary crushing so that the minus ¼-in. stone going to the heated screens always has some moisture in it; enough to give the stone a darker tinge than the dry stone. The heat given off by these screens is not enough to dry the rock. The cloth feels warm to the hand, but the heating does upset the tendency for damp fines to cling to the cloth.

## Dust Control Systems

The Prospect plant uses the Johnson-March system of dust control. This system is built around the idea of stopping dust before it starts. This is accomplished by spraying the rock at selected points with water that is charged with Johnson-March Compound "M," a wetting agent that spreads or diffuses through the rock fragments. Using this system, only about one-half of one percent moisture is required to keep the dust count down to a point that will meet New York state dust regulation requirements. The rock at Prospect tends to break to form an excess of finer sizes, and even during the dry summer the amount of dust issuing



Left: Loading large capacity diesel truck in quarry with 2½ cu. yd. shovel speeds operations

Right: Overall view of stone plant with trucks unloading into primary crusher, below, and long conveyor inclining up to plant, above

from the plant is practically negligible.

A second feature of the Prospect plant is the use of a liquid precipitator for controlling dust at the black top plant. The unit is a Johnson-March Corp. "Multiple-Action" scrubber of the vertical type. The shell of the scrubber, which is 10-ft. dia. and 20-ft. high, was supplied by Eastern Rock Products Co. The sketch shows the scrubbing action principles. A 4-ft. dia. exhaust fan introduces the dust stream into the area marked "A" in a centrifugal manner so that the heavier particles work to the outside and downward. From "A" the gases go through a series of six venturis or scrubber throats. Here the velocity of the gases is accelerated somewhat and impinge on plates along with high velocity water sprays. In the lower chamber "D," expansion of the gases allow most of the dust load to be dumped in the form of a slurry with the finer dust particles working upward through a second series of venturis (eight in number) to more impinging plates. Chamber "I" is still another expansion chamber with impinging plates and spray nozzles. The wetting compound "M," previously mentioned, can be used in this type of collector, thereby increasing the recovery of micron size dust particles. The asphalt plant uses a 6- x 29-ft. oil-fired drier with a Hopkins Volcanic Specialties Co. burner. Oil is pre-heated. The mix going to the asphalt plant has from 2 to 6 percent 200-mesh material in it. A 1¼-in. centrifugal pump supplies water for the spray nozzles at 30 p.s.i. Collected dust is sent to a settling pond and wasted. The plant handles 75 to 80 t.p.h.

On cold mornings it takes from 10 to 30 min. for the collector assembly to get heated up, and during that warm-up period gases from the 50-ft. stack appears out of balance due to the steam vapors. Actually during this period the dust count is below requirements and once the unit has become heated, the dust from the stack is practically negligible; so small that the company operates in an area which is each year becoming more residential in nature.

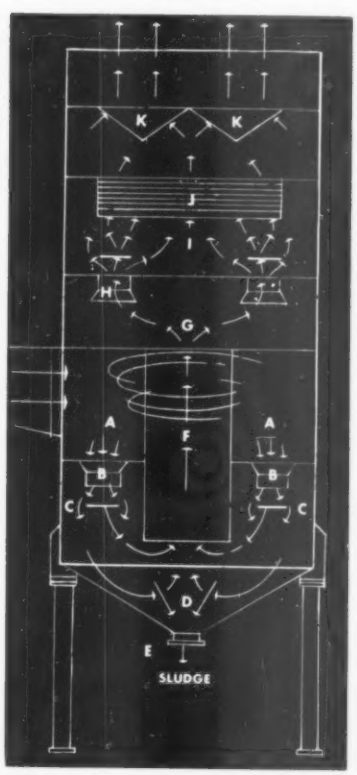
## Prospect Quarry

The Prospect quarry (Plant No. 6 of Eastern Rock Products Co.) is an older operation that employs a 24- x 40-in. Buchanan primary jaw crusher and a No. 9 Allis-Chalmers gyratory secondary crusher. Also available is a 37½ Kennedy-Van Saun reduction crusher and a No. 4 Allis-Chalmers unit. In the re-crushing plant there is a 37½ Kennedy-Van Saun crusher. Screens consist of a 3- x 8-ft. scalper with 4½-in. opening and a 5- x 8-ft. unit. Other screens are a 5- x 14-ft. three-deck unit and the two heated screens mentioned earlier. In the re-crushing plant a Kennedy-Van Saun three-deck screen is featured.

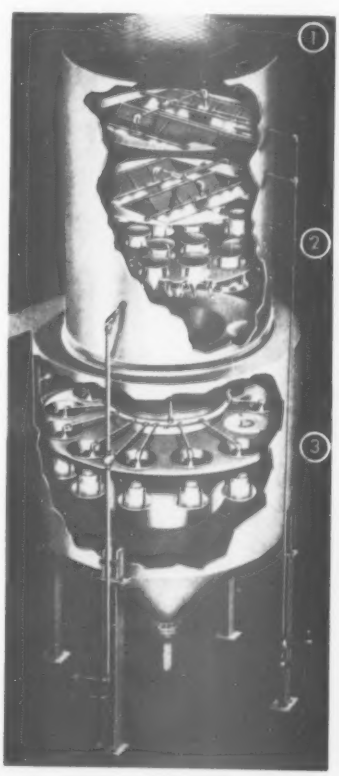
Loading in the pit is done with a 2½-cu. yd. Marion 93-M diesel shovel that loads to Mack trucks. About seven years ago the company moved the primary crusher into the pit so that hauls are now relatively short and over modest grades. The pit is 87 to 92 ft. deep. Primary drilling of 7⅞-in. dia. holes is done with a Joy rotary drill, operated dry. Secondary breakage in the pit is with a 6300-lb. drop ball swung from a K-3 Link-Belt crane. The plant has a capacity of 180 t.p.h.

Eastern Rock Products Co. has two sand plants and another limestone quarry in the Utica area, but the Boonville sand and gravel plant and the

(Continued on page 110)




Showing multiple scrubbing action principles of liquid dust precipitator used at the Prospect plant




Cut-away view of wet type dust collector. (1) At Prospect plant, the top is enclosed; (2) eight venturis or throats; (3) six venturis in lower zone. Gases enter near top and exit through stack near the bottom

## Facts for the Cement Industry on

# FLOW OF SLURRIES

By DR. JOHN R. VAN WAZER*

DUE TO THE GROWING INTEREST that has peen exhibited by the cement industry during the past year in the use of phosphates for deflocculating slurries of shale and limestone being fed to a cement kiln[1], it seems desirable to review the factors involved in the flow of slurries. These factors have been extensively studied over the last three decades and form a chapter in that branch of physics called rheology[2]. In this article, a few of the basic principles of rheology will be reviewed, and the mechanism of the flow of raw cement slurries will be discussed in some detail.

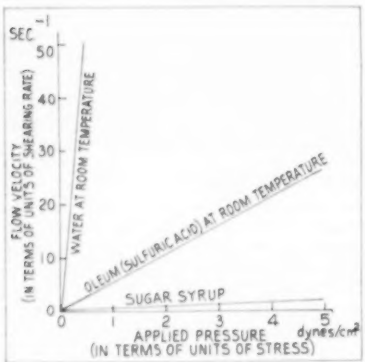



Fig. 1: Consistency curves for three Newtonian fluids

### Information About Flow

Rheology is defined as the science of the deformation and flow of matter. It includes all of those effects which are commonly labeled elasticity and viscosity, and covers the mechanical properties of material things. From a study of the flow properties of all types of materials, it has been found that anything which flows can be classified under one of the following arbitrary categories: (1) normal or Newtonian fluids, (2) plastic or Bingham fluids, (3) pseudoplastic fluids, and (4) dilatant fluids. These four classes can be differentiated from each other in terms of their so-called consistency curves, which are graphs of the speed of flow versus the force or pressure needed to make the fluid flow at that speed.

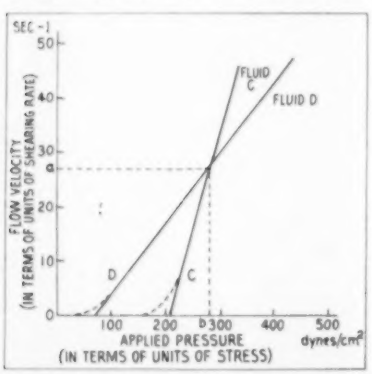



Fig. 2: Consistency curves for two plastic fluids

The Newtonian liquid exhibits the best known of the four types of flow, probably because water is an example of a Newtonian liquid. As shown in Fig. 1, the velocity of flow of a Newtonian liquid is always proportional to the pressure or force causing that flow. When the proper units are used in graphing the consistency curve, the constant ratio of applied pressure to flow rate is defined as the coefficient of viscosity, the unit of which is the poise. For purposes of mathematical convenience, rheologists used a special measure of the speed of flow called the rate of shear, the units of which are reciprocal seconds. Also, instead of directly plotting pressure or applied force in a consistency curve, the rheologist uses shearing stress, which is a force per unit area and is measured in dynes per square centimeter. Properly speaking, it is the constant ratio of shearing stress in dynes per square centimeter to rate of shear in reciprocal seconds which gives the coefficient of viscosity in poises. When someone says that the viscosity of a fluid is 0.01 (in the case of water at room temperature), 0.00019 (as in the case of air), or 2.5 (as in the case of a heavy sugar syrup), he is reporting coefficients of viscosity in poises. Since the consistency curves of all Newtonian fluids are straight lines, one, and only one, viscosity can be reported for any individual fluid at a given temperature.

The *plastic fluid* has properties which are considerably more complicated than those of the Newtonian fluid. As shown by the consistency curves of Fig. 2, a plastic fluid exhibits a yield value, which is a critical pressure above which the material flows readily and below which it acts as a solid and does not flow at all. Until a pressure or force greater than the yield value is applied to a plastic fluid, it just will not flow. It can be seen that the flow properties of a plastic fluid are characterized by two constants, instead of the one constant (the viscosity) which determines the flow properties of a Newtonian liquid. These two constants are the yield value and the so-called plastic viscosity, which is a measure of the flowability of the plastic material after the yield value has been exceeded.

Since the properties of a plastic fluid are defined by two constants, it is impossible to characterize such a fluid by a single measurement. This means that there can be two quite different plastic fluids which will show the same "viscosity" when measured in a given viscometer. In other viscometers, these two fluids might exhibit quite different "viscosities." The two plastic fluids for which consistency curves are shown in Fig. 2 are examples of this type of behavior. When measured at the single velocity of flow labeled *a* or the single pressure labeled *b*, these two plastic fluids would appear to be identical. However, if another single point viscometer which ran at a different rate of flow or pressure (whichever is held constant in the viscometer) were used, fluid *C* could show up as being either thicker or thinner than fluid *D*. Thus at lower rates of flow, fluid *C* would appear to be thicker than *D*, since its consistency curve is lower than that of *D* in this region. On the other hand, at flow rates greater than *a*, *C* would appear to be thinner than *D*.

To state this in more technical terms, one can say that any viscometer calibrated to read in terms of coefficients of viscosity gives a measure of the ratio of shearing stress to rate of shear at a given rate of shear or given shearing stress (whichever is held constant or integrated over a fixed range in the device). This means that a "viscosity" measurement carried out at the point where the two consistency curves in Fig. 2 cross each

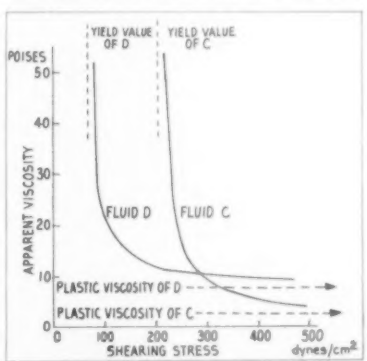



Fig. 3: Change of apparent viscosity with shearing stress (pressure or force to cause flow) for the two plastic fluids of Fig. 2

*Assistant Director of Research, Phosphate Division, Monsanto Chemical Co., Dayton, Ohio

other will measure only the ratio $b/a$. This is true no matter how the viscometer is standardized, even though it is calibrated by the simple procedure of using one or more Newtonian liquids as standards. Direct measurements made on non-Newtonian liquids in a viscometer calibrated to read in terms of viscosity are called "apparent viscosities." Strictly speaking, the only kind of a fluid which really exhibits a single flow constant, the coefficient of viscosity (called *viscosity* for short), is a Newtonian fluid.

The apparent viscosities measured on non-Newtonian fluids vary considerably when measured over a wide range of flow rates or applied pressures. This is shown in Fig. 3 for a plastic liquid. It can be seen in Fig. 3 that the apparent viscosities of the two plastic fluids represented in Fig. 2 vary from infinity down to a number only a little larger than the plastic viscosity of the fluid, when measured over a wide range of applied pressure. The type of viscometer which measures at only one pressure head or only one rate of flow will naturally give just a single point on a curve such as is presented in Fig. 3.

Equations have been developed whereby the yield value and plastic viscosity for the plastic fluid can be determined from measurements made over a wide rate of shear on either a rotational or capillary-tube type of viscometer. These relationships, called the Reiner-Riwlin equation and the Buckingham-Reiner equations, respectively, are usually not employed in application work, being primarily used in theoretical rheological studies.[7] However, the Reiner-Riwlin equation does show that in the commercially available rotational viscometers the bottom part of the consistency curve obtained by plotting the rate of rotation against the applied force will not sharply cut the stress axis, as indicated by the solid lines in Fig. 2, but will curve toward the origin as shown by the dotted lines. This curvature is attributable to the fact that at low rates of rotation, the effective diameter of the outer cup of the viscometer becomes smaller, because the yield value is not overcome by the shearing stress near the wall. This is graphically illustrated in Fig 10. By using cylinders of large diameter with a very small gap between them for holding the fluid under test, the curvature in the measured consistency curve can be made negligibly small.

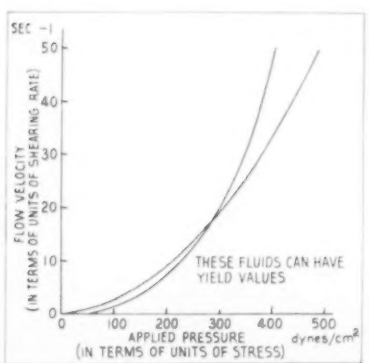



**Fig. 4: Consistency curves for two pseudoplastic fluids**

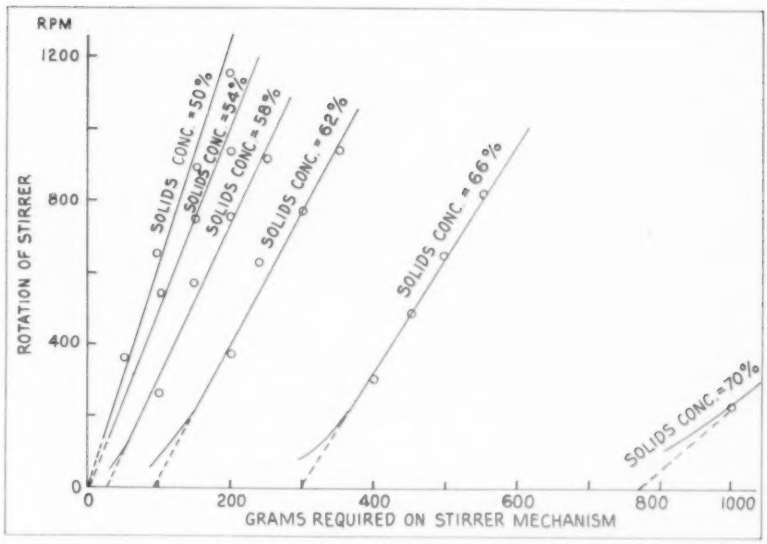



**Fig. 6: Consistency curves of an untreated shale-limestone slurry showing the effect of water content on flowability. Data taken with the Stormer viscometer**

Similarly, the Buckingham-Reiner equation shows that the bottom part of the consistency curve obtained by plotting the rate of flow through a capillary tube against the driving pressure is also curved. At low pressures the flow of a plastic liquid through a tube takes place completely at the wall with the center part of the fluid being extruded as a solid plug. Because of this behavior, this type of flow is usually called "plug flow." Notice your toothpaste tube for an example of such plug flow.

The third type of fluid, the pseudoplastic fluid, is one in which the rate of flow increases a great deal faster than in mere proportion to the pressure causing the flow. Consistency curves for two typical pseudoplastic fluids are shown in Fig. 4. Pseudoplastic fluids sometimes show a yield value. In such a case, it is important not to confuse the real curvature in the consistency curve with the curvature induced by the effect of the yield value as mentioned above for plastic fluids.

The situation for dilatant fluids is just the reverse of that for pseudoplastic fluids, as is shown by the consistency curves given in Fig. 5. As the pressure or applied force is increased, the rate of flow first increases greatly and then levels off, so that finally at high rates of shear an appreciable change in the pressure has very little effect on the resulting rate of flow.

All gases and most liquids of reasonably low molecular weight act as Newtonian fluids. The class of Newtonian fluids thus includes all of the well-known organic solvents, and the standard inorganic solvents such as water and liquid ammonia. In addition, true solutions of both organic and inorganic compounds are Newtonian as long as these compounds are not high polymers. Most thick slurries and suspensions are plastic fluids. Toothpaste is a typical example of a material exhibiting a plastic consistency curve. Solutions and gels of organic high polymers exhibit pseudoplastic flow curves without yield values. This type of behavior is shown by nearly all biological fluids. Gels and greases in which there are several fluid phases and in which these phases are well dispersed are usually pseudoplastic fluids having yield values. Slurries in which the dispersed phase consists of a large number of small, highly charged particles act as dilatant fluids. Concentrated slurries of partially degraded starches are often given as examples of dilatant fluids.

## Flow of Cement Slurries

As indicated by the above statements, the untreated raw slurries used in cement manufacture are plastic fluids. This is shown by the curves of

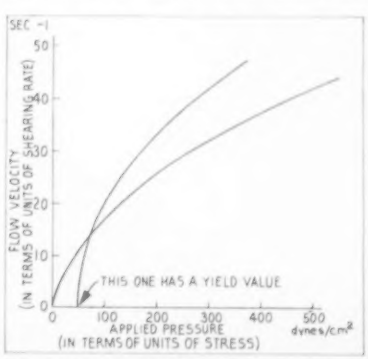



**Fig. 5: Consistency curves for two dilatent fluids**

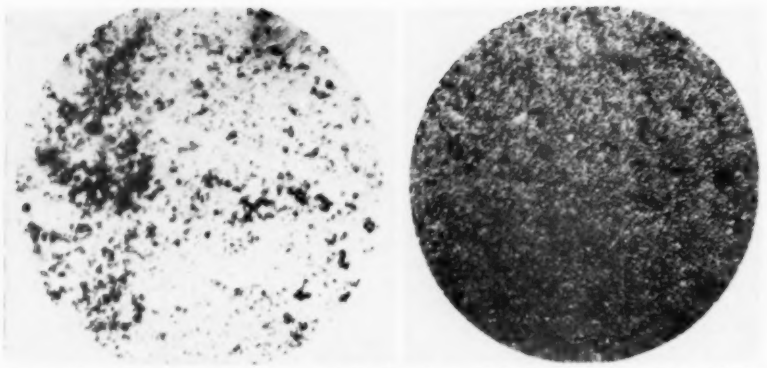


**Fig. 9: Microscopic appearance of an untreated and a well-deflocculated (by sodium tripolyphosphate) raw cement slurry. To the left, untreated slurry; to the right, slurry treated with sodium tripolyphosphate (Magnification 140X)**

Fig. 6. This figure presents data obtained on a shale-limestone slurry taken from a cement processing operation. In order to obtain curves corresponding to different concentrations of solid matter, the original slurry, which had a concentration of 65 percent solids, was diluted with water for the consistency curves corresponding to lower concentrations. The higher concentrations of solids were obtained by evaporating water from the slurry over a steam bath. In no case was the slurry evaporated to dryness.

After being deflocculated with sodium tripolyphosphate, the consistency curves of the shale-limestone slurry become dilatant. This is shown by Fig. 7. It should be noted that not only does the addition of the deflocculant change the shape of the consistency curves; but the curve for a given concentration is shifted very drastically toward the rate of shear axis. It is this effect which gives the great increase in pumpability found by deflocculating the slurries.

A detailed mathematic analysis of non-Newtonian flow curves has shown that, whatever is the unknown rheological equation of the material, a plot of apparent viscosity against the shearing stress at the wall will give a curve which is independent of the dimensions of geometrically similar apparatuses, provided there is no slippage at the wall. The flow curves of Fig. 6 and 7 are replotted in these terms in Fig. 8.

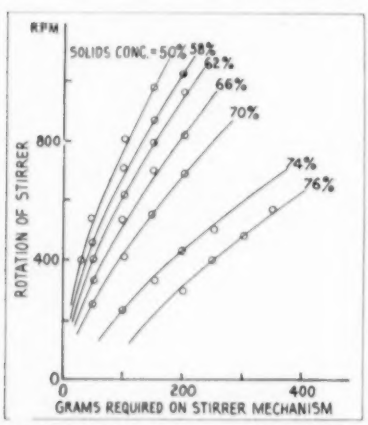



**Fig. 7: Consistency curves for the shale-limestone slurry of Fig. 6, after being deflocculated by 0.1 percent of sodium tripolyphosphate. Data taken with the Stormer viscometer**

## Mechanism of Deflocculation

As evidenced by the existence of the yield value, the individual particles in slurries exhibiting plastic flow properties tend to stick to each other. Indeed, they stick together so strongly that it takes an appreciable force (the yield value) to make them move past each other. When the flow of an untreated raw cement slurry is viewed through a microscope, it is seen that clumps or floccules of particles move past each other, sometimes with a few particles being torn from one clump and attaching themselves to another clump or forming a new one. This shown in Fig. 9.

The effect of a deflocculant, such as sodium tripolyphosphate, is to cause the individual particles to repel each other and hence make the clumps separate. When the flow of a well deflocculated raw cement slurry is observed through a microscope[1], the individual particles are seen to move quite independently of each other, bouncing apart after colliding, as shown in Fig. 9.

It is believed that the deflocculant causes the particles to repel each other by electrically charging the surface of the particles[2]. The anion of sodium tripolyphosphate bears five negative charges and easily forms coordinate bonds with electron acceptors such as the calcium ions on the surface of the shale and limestone particles. Thus, by formation of the coordinate type of chemical bond, the tripolyphosphate anion becomes attached to the surfaces of the particles and gives each surface a negative charge. This surface charge, called the Zeta potential, can be measured by electrophoresis experiments and is shown to be relatively large when the slurry is well deflocculated.

Since the charge is only on the surface of the particles, the smaller the size of the particles, the greater will be the effect of the deflocculant. This is so because the mass of a particle depends on the cube of its dimensions; whereas, the surface area depends on the square of the dimensions. Thus, the ratio of surface area to mass increases in inverse proportion to the dimensions; that is to say, small particles have a greater surface/mass ratio than do large particles. Since the inertia, velocity of motion under given conditions, and other gross mechanical properties of moving particles depend on their mass, it is apparent that the surface charge can only be effective in affecting the motion of particles if the surface/mass ratio is very great. The proper conditions are met in the size region of so-called colloidal particles—particles smaller than about 100 microns and greater than about 0.01 micron. No matter what deflocculant is used, it will not affect the flow properties of, say, beach sand suspended in water or glycerine. The particles are just too coarse.

Now we come to the question of how much can be expected of a deflocculant. Naturally, with the use of any deflocculant, it is impossible to reduce the water content of a slurry to zero and still expect it to flow as a fluid. Since one purpose of adding a deflocculant to raw cement slurries is to reduce significantly the water content and yet retain good pumpability of the slurry, we ask ourselves what is the maximum reduction in water content which can be obtained by use of the best possible deflocculant. This, of course, depends on the average particle size of the slurry—the smaller the particles, the greater the reduction in water content. This reduction in water content is attributable to the breaking up of the agglomerates of particles. In the agglomerates, the particles are arranged in a haphazard fashion with large interstices between them. A considerable amount of water is entrapped in these interstices—water which does not aid in the flow of the slurry. When the haphazard agglomerates, which have been likened by some to a house of cards, are broken down by the de-

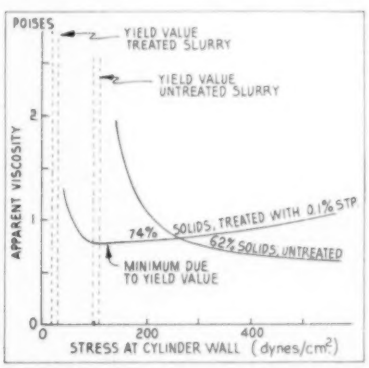



**Fig. 8: Variation in apparent viscosity with shearing stress of the untreated slurry in Fig. 6 and a deflocculated slurry of Fig. 7, having a considerably higher solids concentration as measured in a Stormer viscometer**

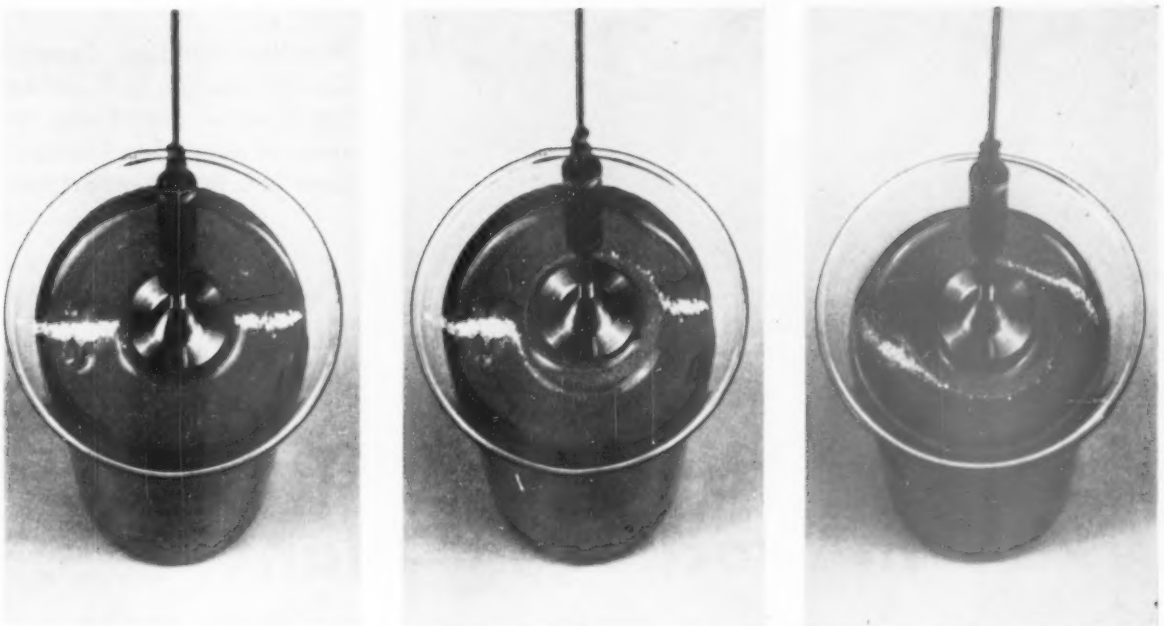


**Fig. 10: Illustrations showing the reduction in yield value of a slurry after treatment with sodium tripolyphosphate. Left: Untreated slurry, before rotation of cylinder. Center: Untreated slurry, after rotation of cylinder. Yield value indicated by lack of movement of reference line except where adjacent to cylinder. Right: Same slurry treated with STP, after rotation of cylinder. Reduction in yield value shown by spiral appearance of reference line, which indicates flow out to the container walls**

flocculant, the water thus released thins the slurry considerably.

Before the slurry was deflocculated, it exhibited a large region of plasticity in which the slurry became progressively thicker and thicker as the water content was reduced. It is this long plastic region (in which the water content can be varied considerably without the slurry becoming either soupy or dry and crumbly) that allows pottery clay to be worked on a potter's wheel. When a deflocculant is added, the plastic region is greatly reduced, and the slurry tends to pass directly from a soupy condition to a crumbly state as the water content is lowered. This behavior is attributable to the surface charge on the deflocculated particles which makes them repel each other and hence allows them to slip past each other easily, as long as there is space to do so. However, when the amount of water is reduced to the point where the total volume of the slurry is equal to the volume of the tightly packed particles, the particles can no longer move past each other without expanding the total volume or breaking up the mass[5]. This effect is called crumbling.

The settling of larger sized particles in a raw cement slurry depends to a great extent on the yield value. When the yield value of the slurry is high, there is no tendency for the large particles to settle out of a suspension of the fine particles. There will, of course, be a general settling of all the suspended matter, under these conditions. This is evidenced by the formation of a top layer of clear water. In an untreated slurry, the lower floccules are pressed together by the weight of the mass of floccules on top of them, and thus the upper layer of clear water is extruded from the mass. Addition of a deflocculant causes a large reduction of the yield value and hence promotes the settling of large particles from suspensions of fine ones.

## Conclusions

Addition of a deflocculant such as sodium tripolyphosphate to a raw cement slurry has several important results. First and foremost, the water content of the slurry can be considerably reduced, with the greatest reduction in the thickness being achieved for slurries with small particle sizes. At the same time, milling and settling can be improved by the reduction of yield value. Concomitant with these improvements it is noted that the character of the flow changes from the plastic to the dilatant type. This affects the pumpability of the slurry.

Although nothing was said of the matter in this article, the exact chemical constitution of the soluble and insoluble materials present in the slurry has quite an effect on the amount and type of deflocculant that should be used. For example, the thickening effect of gypsum inadvertently milled into cement shale has been discussed in ROCK PRODUCTS, May, 1953. This problem has been permanently solved by elimination of gypsum contamination; and it has been shown that use of as much as 0.4 percent of sodium tripolyphosphate instead of the usual 0.15 percent concentration will also correct the problem. Other individual problems, due to the chemical peculiarities of the slurries used in different plants, can also be solved by the proper application of scientific principles.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[4] **J. R. Van Wazer, "Rheology"** in Volume XI of the Encyclopedia of Chemical Technology (Editors: Kirk and Othmer), Interscience Pub. Co., New York, 1953.
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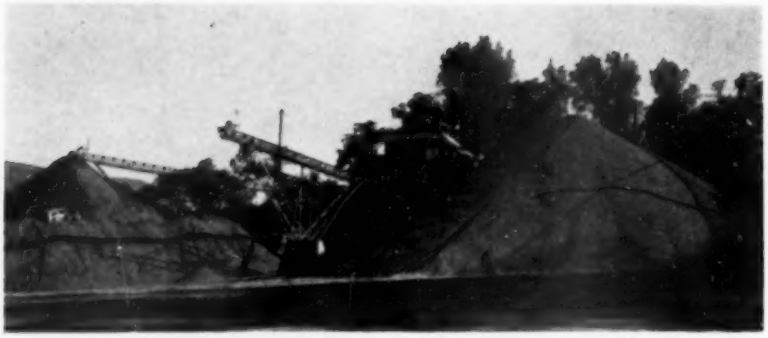
## Receives Quarry Permit

CLEVELAND STONE CO. has been granted a "hardship" permit to operate a stone quarry in Columbia, Ohio. The permit was granted by the township's zoning board of appeals, following the zoning inspector's denial of an earlier request. The quarry had been inactive since 1927, and a zoning code classifying the area as residential was passed in 1948. The "hardship" permit specifies that only "loose" stone may be removed, due to the local residents' opposition to blasting. The crushed stone will be used as fill material on the Ohio Turnpike.

## Slag Plant

NATIONAL SLAG, LTD., is a new company recently organized and jointly owned by Canada Crushed and Cut Stone, Ltd., Hamilton, Ont., Standard Paving and Materials, Ltd., Toronto, Ont., and Buffalo Slag Co., Inc., Buffalo, N.Y. Plans have been announced to build a $1,000,000 plant near Hamilton for processing blast furnace slag for concrete aggregate.



Four stacker belts stockpile two sizes of sand and two of gravel

**Windsor Building Supplies Co., Newburgh, N.Y., makes two sizes of gravel and two sizes of sand. Sand scalper-sizer is a four-compartment settling device**

By WALTER B. LENHART

# Unusual Sand Recovery System In "Packaged" Plant

DUE TO THE DEPLETION of an older deposit near the southern edge of Newburgh, N.Y., the Windsor Building Supplies Co., Inc., found it necessary to open a new pit and plant at Plum Point. The Plum Point operation is a few miles down stream from the older operation on the west flank of the Hudson river. The deposit, which is estimated to have a 20 to 25-year life, is high in sand. Two sizes of gravel are recovered and also two sizes of sand, a concrete sand and a masons sand. However, a small amount of minus ¼-in. crushed chips are removed and kept separate.

## "Packaged" Plant

The new plant might be called a "packaged plant" in that the bulk of the screening and washing equipment was supplied in one package by the Universal Engineering Corp., Cedar Rapids, Iowa. This company also supplied the designs for its assembly with E. Lee Heidenreich, Jr., consulting engineer of Newburgh, N.Y., doing the general lay-out work. This comprised the belt conveyor system, stacker belts and the dock loading section. Local contractors built most of the plant under the supervision of the staff of the Windsor Building Supplies Co., Inc.

Unusual features of this all-steel plant revolve about the recovery and subsequent handling of the two sands. Screening is quite conventional and involves the use of two 5- x 12-ft. Simplicity three-deck screens, operated wet, that receive a split feed by belt conveyor from the truck hopper. The wire mesh on the screens is 1¼-in., ¼-in., and 10-mesh, respectively. The plus from the top deck is placed in the bin that supplies trucks or, the oversize can be chuted from the side of the bin to a 36-in. Telsmith cone crusher. Throughs from the crusher are moved by belt conveyor to a small 2- x 8-ft. Simplicity two-deck screen, operated dry, that removes the minus ¼-in. chips. Products from the top decks of this chip screen return to belt conveyor No. 1 serving the main plant. The chips fall to a steel truck-loading bin, and are sold separately. This set-up permits some measure of control over the amount of crushed material in the gravel sizes to meet New York's specifications for fractured particles.

## Washing and Scrubbing

The minus 1¼-in. plus ¼-in. material falls to a steel hopper type truck bin where it can be loaded to trucks, or it can be withdrawn from the side of the bin via a short belt to a small 24-in. x 15-ft. Eagle log-washer-screw-type scrubber. After scrubbing in the washer the material falls to a 4- x 10-ft. Kennedy-Van Saun two-deck screen, operated wet, which prepares a minus 1¼-in. plus ⅜-in. gravel, and a minus ⅜-in. plus ¼-in. size. The minus ¼-in. from this rinsing operation is sent to the tailing pond. The two gravel sizes fall to stacker belts for ground storage. Reclaiming from these piles is by a 301 Koehring clamshell, or a Haiss loader.

The minus ¼-in. plus 10 mesh from the top of the lower deck of the two 5- x 12-ft. Simplicity screens falls to a third hopper bin. This bin can also load to trucks or, the material may be moved by a Syntron electrically-vi-

Double-deck screen removes minus ¼-in. material from crushed gravel

brated feeder for blending into the concrete sand in the de-watering screws.

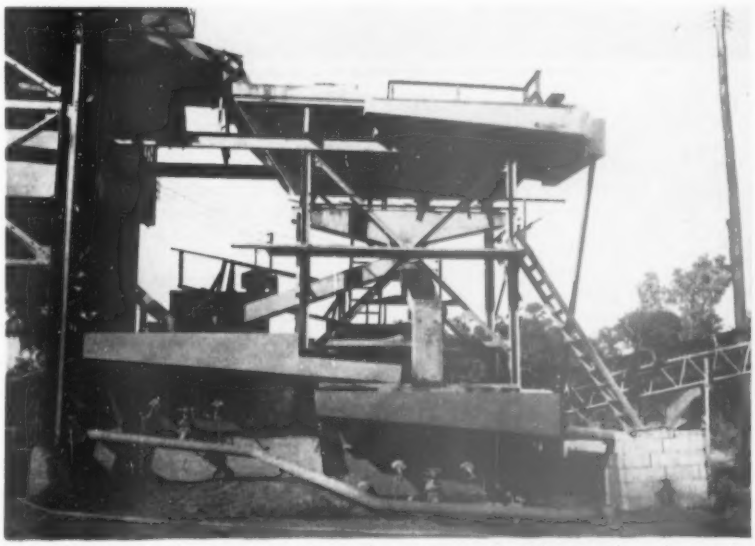
The log-washer-screw mentioned in the above paragraph has half the flights of the log-washer-paddle type with the other half being of the screw type. This design gives the gravel adequate scrubbing before sending the material to the Kennedy-Van Saun final screen.

The sand recovery involves the use of an Eagle sand scalper-sizer. This is a four-compartment settling device. The minus 10 mesh from the lower deck of the two Simplicity screens flow into one end of the scalper-sizer, and the fines (mostly minor amounts of clay in suspension) flow out the opposite end to the tailing pond. The four compartments have a total area of about 10- x 20-ft. The line drawing gives the general features of one of the compartments in the scalper or sizer. When the sand in any one compartment builds up to the pre-determined amount (or weight), the valve at the cone's outlet functions to unload the cone to equilibrium. Tension on the valve is maintained by a coiled spring with tension nut at the top of the rod that is a part of the unloading assembly.

The four compartments unload to a wide V-shaped steel launder with all four sizes converging at the bottom of this launder. At the outlet point of this launder is a splitter or flop gate. This gate helps split the stream of sand into two fractions; a coarse and a fine. The illustration shows how these two sizes of sand tend to keep separate but the splitter gives additional and a finer degree of control. The two sizes from the splitter each go to a 36-in. x 25-ft. double Eagle screw-type de-watering unit. However, as the sand going to the two de-watering units is all minus 10 mesh, some coarser sand must be blended to the concrete sand. This is accomplished by taking some of the minus ¼-in. plus 10-mesh size from the steel bin and using the Syntron feeder, previously mentioned, this size is blended into the twin Eagle that recovers the concrete sand. The two sizes of sand are ground-stored in stockpiles alongside of each other. Overflow from the two twin Eagle de-watering screws goes to the tailing pond.

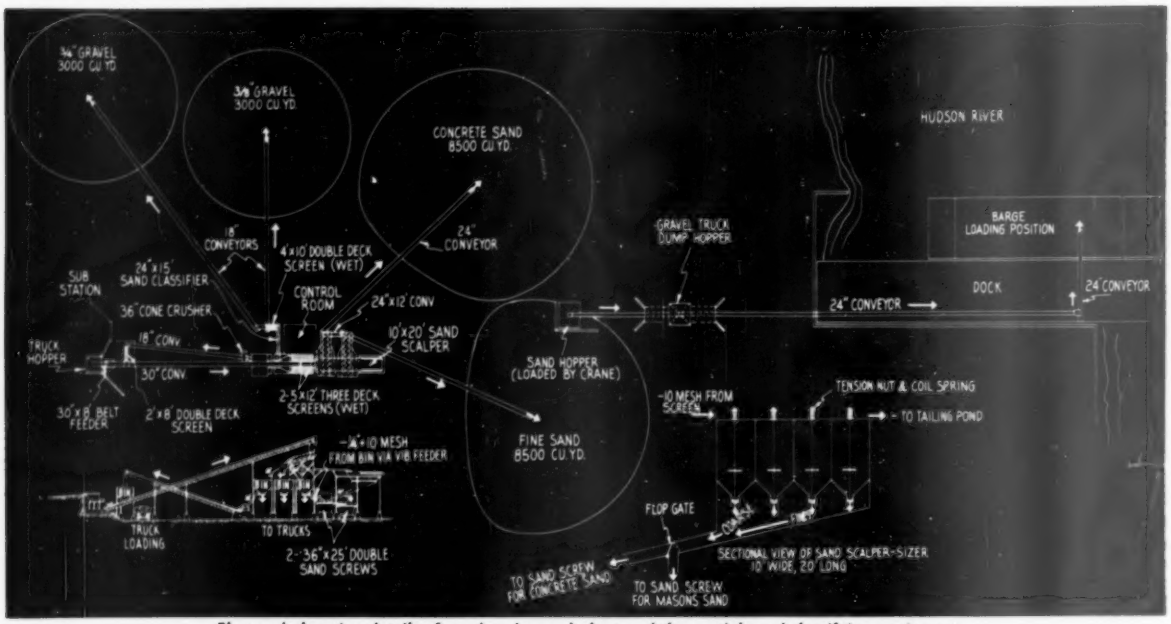
As a high percentage of the plant output is shipped by barge, especially the sand fractions, a reclaiming tunnel of Armco steel has been provided. This tunnel ends near the two sand piles and is between the two. Near the end of the tunnel, a hopper has been provided with a gravity feed gate to the reclaiming tunnel and a 301 Koehring clamshell casts sand from either pile to the reclaiming belt conveyor. In addition, a second hopper nearer the shore line has been provided so that trucks can dump to the hopper and the material be sent to the barges. Barge loading is conducted at a rate of 150 t.p.h. The barges hold from 550 to 600 tons each.

**Overall view of compact, efficient sand and gravel plant. In the foreground may be seen the cone crusher, and above are two 5- x 12-ft., three-deck screens**



**Sand scalper is a settling device with four outlets at bottom. Sand fractions from these outlets are split to the two double sand screws, producing concrete sand and masons sand**

**Steel pipe tunnel for reclaiming belt conveyor with barge-loading facilities in the background**




**Plan and elevation details of sand and gravel plant and the special sand classifying equipment**

In the pit is a 40-ft. face of material which is loaded into trucks with a 1-cu. yd. 401 Koehring shovel, the pit-run material being delivered to the hopper serving the plant by contract trucks. The haul is about 150 yd. on a flat grade. A belt-type feeder under the truck hopper serves belt conveyor No. 1 inclining up to the two screens in the plant. A small amount of large sized gravel is discarded at the grizzly over the truck hopper. The plant has a nominal capacity of 150 t.p.h.

All plant operations are controlled from an operating station high in the screening tower so the operator, by means of push button controls, can easily operate the plant. Tailings are sent to a tailing pond, which is a marshy area, with the idea that eventually this marsh-land will be filled and used for other purposes. Water is supplied by an Ingersoll-Rand pump at the rate of 1200 g.p.m. The pump is powered with a 150-hp. motor.

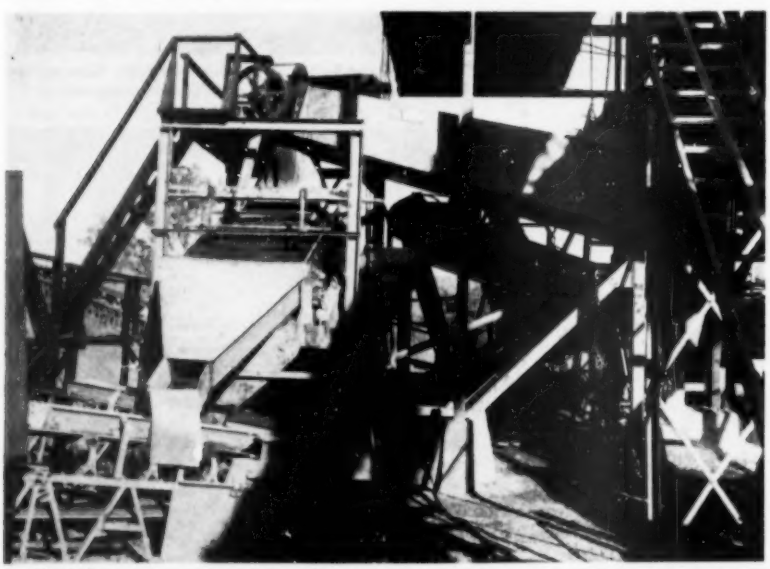
The operating offices of the Windsor Building Supplies Co., Inc., are on River Road, Newburgh, N.Y. This was the site of the older plant where the deposit is now depleted. The company also has a sales office and outlet at 490 Broadway in the city proper. George R. Krom is president of the Windsor Building Supplies Co., Inc., and Edward G. Kolb is vice-president and treasurer. Edward P. Kolb is plant manager. The company has a branch at Poughkeepsie, N.Y., which is under the management of Donald Krom. George R. Krom, Jr., handles the building supplies for the Newburgh area. The company is also affiliated with the Hudson Valley Concrete Corp.

## Dust-Free Plant

*(Continued from page 102)*

Oraskiny Falls rock plant are the better known operations. The company has pioneered the use of "Colprovia" a cold mix bituminous material, and in addition has two construction crews on road work.

Harold V. Owens is president and general manager; J. V. Owens, vice-president and production manager, and C. A. Munz, sales manager. Jess Haney is rock plant superintendent at Prospect and Bob Santmier, asphalt superintendent.



**Double-deck screen makes two sizes of gravel, ⅜- to 1¼-in. and ¼ to ⅜-in., with the minus ¼-in. size being wasted. Gravel is given preliminary scrubbing in the screw-log washer, above and to the right of screen**

**Bob Santmier, left, superintendent of blacktop plant, and Jess Haney, rock plant superintendent**

## Theory and Practice of

# LIME MANUFACTURE

By VICTOR J. AZBE*

### Part VII. Temperature control of high capacity kilns

EVERY SCIENTIFIC PAPER ON LIME issued by the various research laboratories exalts the soft burned lime, but they still leave us with the problem of how we are to produce it. The inefficient kilns of old approximated it, but not today's high capacity kilns that have not yet been subjected completely to calcining temperature control.

In the entire field of combustion engineering there has hardly been an apparatus more difficult to subject to rationalized temperature control than the lime kiln. Methods were practiced to achieve this, such as the burning of fuel with excess air, or burning with insufficient air, by recirculating the moisture laden air; cooled kiln gases; or the injection of steam into the furnaces. Even imperfectly burned lime was deliberately drawn which still contained core, because the calcining core tended to exert a cooling effect, and at least in the proximity of the core the lime was soft burned.

All of these methods served their intended purpose to some extent, but none of them were entirely satisfactory or reliable and none were technically rational. Some benefits were derived, but in other ways harm was done. A more desirable product was obtained, but not assuredly, and at an extra cost of fuel and labor and of impaired kiln capacity.

It has been a very unsatisfactory state of affairs, a very perplexing problem, the solution of which was long in forming since the only satisfactory solution was not only one which would accomplish temperature control, without attendant harm, but, on the contrary, would enhance the performance of the plant as a whole; that is, it would actually raise thermal efficiency rather than lower it, raise capacity, facilitate operation and obviate the overfrequent necessity for repairs.

It was a problem because whatever the unit, furnace or a boiler, the raising of thermal efficiency always resulted in higher temperatures and often in damage. Thus efficiency was deliberately limited, and the cost of wasted fuel balanced against cost of repairs. For example, this was the case with power stations, but not for long as they soon resorted to water cooled walls. But they only had the wall problem, not the product quality problem as we have in lime. Water-cooled walls hardly would be practical in a lime kiln.

In the more recent kilns of today the problem has been solved through discouragingly slow development. The approach was not practical. It was theory that guided the way; the application of thermodynamic and aerodynamic factors, of many trials most of which were only partially successful, but with errors committed, analyzed, then compensated for or eliminated. The result is that now the highest of possible thermal efficiency and capacity is possible with greatly lowered damage to the kiln and lime.

That there has been trouble is no wonder. In the kiln we have a "basic" substance, "lime," and the "acid" substance "wall" which, at high temperatures, tend to combine to form a sort of "glass" of much lower melting point than either. The same applies to lime itself in its relation to the foreign matter that it contains.

We were confronted with these undesirable high temperature chemical combinations, and on the other hand we did not know how to attain high efficiency and capacity without also developing a high temperature. Simultaneously there was a continual rise in cost of fuel and labor as well as ever more severe competitive conditions which demanded both lower production cost and higher quality.

In a lime kiln, the terminus of the calcining zone before lime passes into the cooler, where lime has virtually no core, with most of it fully heated to the zone temperature, and so of little further heat absorbing capacity, may be called an "athermal chamber." Into this chamber is introduced a combustible of high thermal and likely, of high preheat value. On its entrance it meets a stream of high temperature air at perhaps 1600 deg. F., which arrives preheated from contacting the lime in the recuperative cooler. Meeting of the combustible and the air stream is ordinarily turbulent and conducive to very rapid mixing. Temperatures rise very rapidly. The hot lime surfaces favor a state of the almost instantaneous "surface combustion" at a tremendously rapid rate of heat evolution. Under the conditions of no excess air and complete combustion, dictated by the desire for high thermal efficiency, and with no core (desired for quality), the heat generated has no place to escape and very high general temperatures develop. Fig. 1 presents at "A" the potential temperature that would be attained if the above conditions fully prevailed (see page 113).

Exothermic reactions come increasingly into play; the combination of the lime with silica and alumina of the wall, and the combinations within the lime of the argillaceous, silicious and ferruginous silt and also other minerals admixed with the calcareous deposit ages ago. These are what we tend to call "extraneous matter," since they would not be impurities in all cases. They are present in greatly varied distribution admixed as separate entities, not in chemical combination. But if they present a large surface to the calcareous mass and are of readily combining tendency, then reactions with lime will occur and, as these are exothermic; that is heat generating, temperature will rise above the already high surrounding temperature, further speeding the reactions and the deleterious effect.

Due to the heat of combustion and the additional heat of component reaction, a fluid or semi-fluid plastic state can readily prevail within a piece of lime, particularly around eutectic centers without much external evidence of its presence. It is a common condition favoring the inclusion into the structure of more lime than is required by the simple combination of the calcio—silicate, aluminate, and ferrate compounds that are formed. The remainder of the embraced CaO portion becomes merely isolated, but whether combined or merely isolated the action impairs the eventual CaO availability of the lime.

Then there is the problem of simple consolidation, or shrinkage, with the lime getting heavier. All lime has some of this tendency, a drift toward the high density of the calcium oxide crystal. For pure lime, the tendency is less noticeable, and for any quality lime at lower temperatures also very much less. But when there are impurities, especially certain of the more fluxing kind, then there is a softening,

*Azbe Corporation, St. Louis, Mo.

a gliding of masses into more compact form (denser) of much lower internal surface area, coarser in structure as quick lime, and also later as hydrate. While it may not necessarily destroy the CaO present, it does impair some of the desirable characteristics of lime.

Under the influence of excessive temperature, only 5 percent of the impurity, if particularly harmful, may completely destroy the value of the lime. This can be observed in many plants where black clinker-like masses of lime from poor quality ledges of stone have to be sorted and discarded from the general kiln draw. Still, such stone, if calcined at low temperature is likely to give a white, acceptable lime. This is a very important consideration, a serious matter, particularly in plants where quarries have impure ledges or in countries where most of the limestone is of such an "off" quality.

What makes it worse is that the state of kiln atmosphere at the point where the temperature is likely to be the highest is "reducing." In such a case, the above combinations tend to occur at a lesser temperature, fluxing is by one or two cone numbers lower than in an oxidizing atmosphere.

Thus, in a lime kiln we may have conditions bordering on those of a cement kiln clinkering zone. A state which will cause dead burning, sintering, fluxing to the point of massing and occasional dripping, all damaging to chemical properties of lime and to any kind of refractory present.

We say "may" as there are factors that are likely to assert themselves and prevent the maximum of these temperatures from developing. At the very highest temperatures, there are some endothermic dissociations of $CO_2$ and $H_2O$, tending to reduce the attainment of the maximum of temperatures, but these exert their influence only at the very highest of temperature levels. Below this there may be cooling if some core remains which, however, is not wanted either. There may be the cooling effect of excess air, or the lime cooler may not have been effective and the combustion air not fully preheated. There may be a deficiency of air or imperfect mixing of the fuel and air resulting in incomplete or delayed combustion. The latter may be so long delayed as to become classified as the undesirable secondary combustion, taking place in the preheating zone or even in the exhaust fan.

All of these conditions are undesirable. None of them are true control factors, all being accidental, which may or may not prevail and limit the temperature. Or they may limit it too greatly, particularly when several of these, being uncontrollable, may by chance occur at the same time so one may have a cold, or an overly hot kiln, or what is worse, a kiln giving overburned and under-burned lime in a hopeless mixture.

The old type kilns were not prone to such excess temperatures. They were of low capacity, and low fuel efficiency. They were operated on natural draft, the stone was hand broken and very large. Among such stone the flame would percolate readily, diffuse widely, and burn gradually. Most of the kilns were hand fired. After each firing a state of incomplete combustion prevailed. Then after the volatiles were exhausted, there was a state of excess air. Both of these conditions had a temperature lowering tendency. Only for a very short period between two firings was there what one would call an ideal state of combustion. However, fuel consumption was double.

When the lime was drawn, the fires were cleaned, all of the coals were raked out and the kiln trimmed. During this state, the kiln and its charge became well cooled off, which was seldom less than half an hour, and, when the hang was hard, as long as two hours were lost before the firing was again resumed.

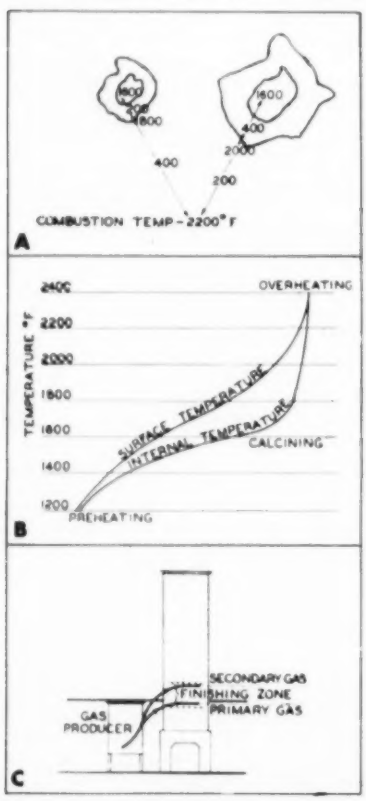
In all cases with these kilns, lime was drawn very hot. In many kilns, the lime draw outlet was even sealed. No air was allowed to enter. The lime cooling zone of today was then really a soaking pit, within which much of the residual core was calcined. With this zone not functioning as an airpreheater, the fuel was burned with cold air entering directly through the grates or the firing door. This in itself reduced the calcining zone temperature by several hundred degrees.

The lime was good. It may have contained some core in the largest of the lumps but that only made it better. After cooling on the draw floor, it was cored and that was that.

Kiln capacity ranged from 7 to 17 tons, the latter being from rather large kilns. Coal cost was about $2.50 a ton delivered to the plant. Efficiency was not particularly important. There was a fireman for each kiln working in 12 hour shifts, getting about 30¢ an hour. They were a special breed of men, many of them were foreigners and quite expert at their job. They had a fairly easy time of it except when trimming, sitting in a group in the shade of a cliff, or tree, or around a pot bellied stove. The kiln then could be built for $5000, and there were rows of them often each with its own fireman. Ordinary firebrick such as Walsh XX had a good reputation and long kiln runs were obtained.

It was only with the application of mechanical draft that a change was brought about, and then the introduction of the center burner, which allowed the use of still higher draft as well as full recuperative use of the lime cooler. Capacities rose rapidly, from 500 lb. per square foot of shaft area to 1000, then 2000, the presently 3000 lb., and the rate is still climbing toward 4000 lb. and no one knows how far beyond that they may go. The 4000-lb. rate seems today to be the possible limit for stone passing an 8-in. screen.

We imagined that the changeover was slow, but actually it was faster than we could completely adapt ourselves. From 8,000,000 B.t.u. per ton, we moved to near to 4,000,000 B.t.u. and with dolomitic stone to less than




Diagrams of temperature control factors, (A) to (C)

(A) This indicates the effect of internal heat flow resistance on surface temperatures of the lime and on likely consequent overburning. Small stone has a lower internal resistance, and therefore a lower surface temperature, giving a softer burned lime even though the external temperature differential is greater, leading to a higher rate of calcination

(B) During calcination, surface temperature rises slowly, while internal temperature remains fairly constant until toward the end of the calcination period when both rise very rapidly. It is during this over-heating period when most damage is done. Lime should be moved into the finishing zone before overheating begins

(C) The combustible should enter the kiln on two levels in the ratio of about one-third at the lower and two-thirds at the upper level. This establishes a mild temperature "finishing zone" within which gas is burned with a large amount of excess, but highly preheated air

4,000,000. This meant that the air preheat was much greater, since if twice the lime is made per pound of coal, the air arriving through an effective cooler would be twice as hot and the resultant hot zone temperature much higher and well above the critical lime and refractory damaging point.

If a high calcium kiln operates on 5,000,000 B.t.u. per ton, a dolomite calcining kiln should not require over 4,000,000. Supposing lime leaves the calcining zone at 2400 deg. F., the heat recovery efficiency of the cooler is 90 percent, and the amount of air passing through the cooler 70 percent. Under these conditions the average air preheat will be 1600 deg. F. for the high calcium lime and over 2000 deg. F. for the dolomitic lime kiln.

As air entering the calcining zone of the dolomitic kiln will be 400 deg. F. higher, combustion temperature will be hotter. Dolomitic lime is more prone to overburning, and any overburning that occurs does far more harm than in the case of high calcium lime.

In 1911 Messrs. A. V. Bleininger and W. E. Emley of the United States Bureau of Standards presented a paper entitled, "The Burning Temperature of Limestone" based on tests conducted at the Bureau before the old "Lime Manufacturers Association." This paper reviewed the problems involved in burning limestone with impurities in the shape of clay, silica, iron oxide, alkalies, carbon, pyrites, etc., and described calcining tests to determine the lowest practicable temperatures. The following is an excerpt from this paper:

"In burning an impure limestone we are placed between two conditons. In order to make the best quality of lime we should burn as close to the minimum temperature (1616 deg. F.) as possible, and to burn with the greatest output we should burn at as high a temperature as possible. It is evident that the result must be a compromise. We must sacrifice a little as regards to quality and more with reference to kiln output.

"Stone of 37 varieties was calcined in amounts of 4 lb., each, walnut size, placed in fire-clay saggers, inserted in a furnace which was preheated for 18 hr., the test temperature maintained for 4½ hr. followed by 12 hr. kiln cooling time. From tests of these 259 samples of lime it was deduced that for good lime the following maximum temperatures should prevail.

"High calcium lime, low in purities 2370 deg. F. and above

High calcium lime, high in impurities according to the amount of the latter 1920-2190 deg. F.

Magnesium lime, low in impurities 1830-1920 deg. F.

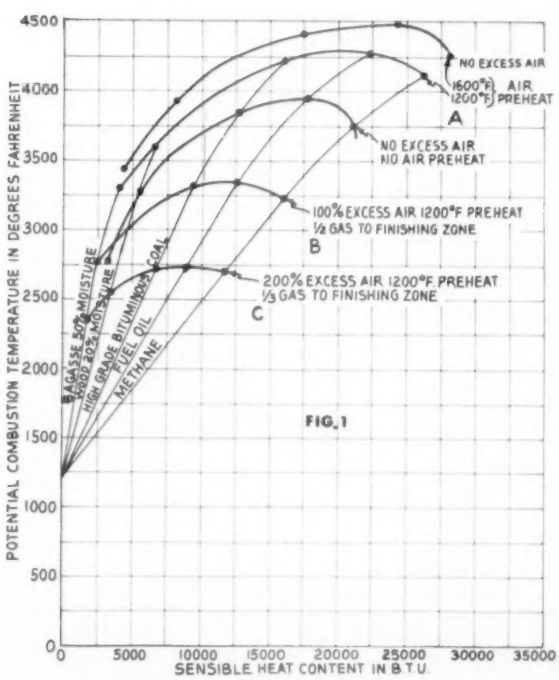
Magnesium lime, high in impurities 1650-1920 deg. F.

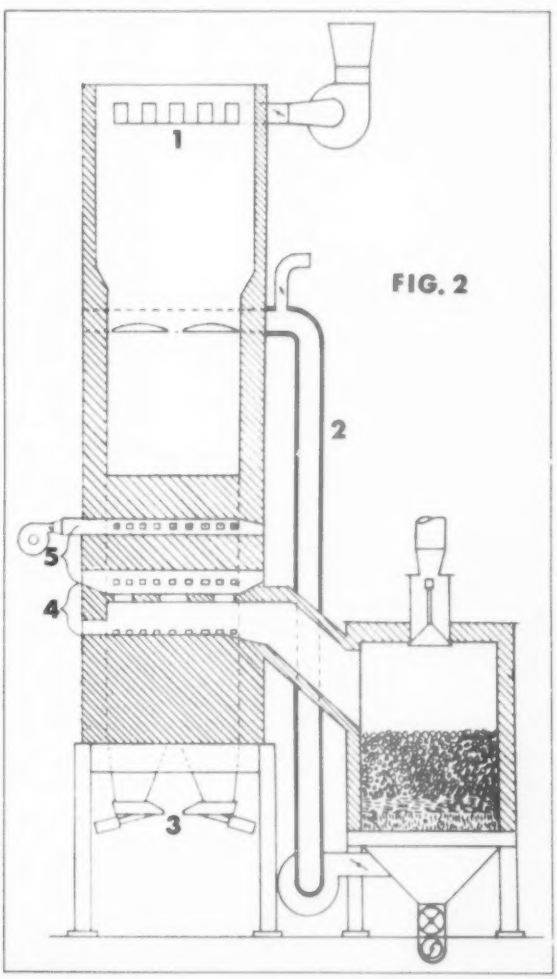
"It is evident that no absolutely hard and fast rules can be given inasmuch as the character of the impurities has much to do with this matter. Thus, if they consist to a large part of iron oxide they are bound to be more hurtful than alumina."

Except for the first of the above, such low temperatures are not obtainable in a high capacity, high thermal efficiency kiln except by special means. A technically sound solution was demanded, but 40 years have passed without it. To give the kiln less fuel was not the answer. A small

**Fig. 2: Methods of achieving lime kiln temperature control: (1) stone size limitations; (2) calcining zone recirculation; (3) frequent lime drawing; (4) calcining finishing zone; (5) long flame radiant zone**

**Fig. 1: Potential combustion temperature; corrected for dissociation of $CO_2$ and $H_2O$—otherwise complete combustion athermal conditions, all fuels at 60 deg. F.**



flame is as hot as a large flame. The match flame fully as hot as the bonfire. How is the temperature to be controlled and limited when for efficiency reasons combustion air is highly preheated, when for reasons of heat transfer and complete combustion, the mixing must be intimate and turbulent, when for reasons of lime quality the terminal zone is of no further heat absorbing power, and when for economic reasons capacity must be the highest attainable. A sound, thermally efficient, practically adoptable solution was seemingly impossible.

The approach is by the following described methods, the number of which refer to the corresponding numbers of the schematic sketch Fig. 2.

### Temperature Control By Stone Size Modification

Smaller stone will have a smaller required calcining depth, a lesser distance for heat to travel, a lower thermal resistance. Heat will diffuse through the smaller piece of lime much faster and therefore the surface temperature for an equal kiln temperature will be much less.

To calcine the core of a large piece of lime requires a higher surface temperature as well as considerably more time, and as lime is impaired by both excess temperature and excess time there is a doubling in impairing effect. Operating at high capacity rates with large stone, the lime will be damaged far more due to surface overheating than with small stone.

To charge as a mixture stone greatly varied in size and required calcining time will result in either one carrying core, or the other being overburned. Separate sizes of reasonable range should be calcined separately. Selection should be by calcining time required, rather than by size, which rules out the square screen for one of oblong openings.

The drift should be toward calcination of ever smaller stone in the degree that the small stone kiln becomes adapted to such small stone, in which there is a continual development.

### Calcining Region Intra-Zonal Recirculation

The method is now widely used by means of which high calcining zone temperatures are tempered by lower temperature calcining zone gases. It involves recirculation of hot kiln gases within the same zone.

A current of hot gas is withdrawn from approximately the point of incipient calcination at a temperature of about 1650 deg. F. It is immediately admixed with sufficient air to lower the temperature to a level allowing its propulsion by fans or propulsion by a jet, or a combination of fan and jet, at temperatures up to or in excess of 1000 deg. F.

This gas is recirculated as a blast through wood or coal fed gas producers, or through specially devised oil gasifying chambers. As such it serves as the gas producer and also a kiln heat tempering medium. The very high $CO_2$ content of the gas at the rather high temperature confers certain additional thermal as well as operational advantages to the gas producer operation such as complete elimination of clinker and increase of carbon conversion to CO rather than $CO_2$. In case of fuel oil, it enables proper pre-gasification of the oil, which in the case of lime kilns is otherwise not possible and the tempering of the very extreme temperatures characteristic of this fuel. Intra-zonal recirculation is also advantageous when natural gas is the fuel.

The recirculating gas, after having served its purpose in the gas producer system, part of it as a reaction enhancing component and part of it as a temperature modifying component; and after having also served in the kiln as temperature modifying, mass velocity increasing and gas distributing, returns to the point of its original offtake at the same temperature and the same heat content, except for that loss by the duct and fan surfaces through radiation with the latter, but limited by insulation.

The intra-zonal system of recirculation is quite different from the inter-zonal method which recirculates cooled, moisture laden air containing gases from the preheating zone, going in small measure to the producer, with most of it directly to the kiln. Only a small volume of such gases could be used and the various benefits enumerated would not be attained in either the gas producer or in the kiln.

### Temperature Control Through Frequency of Draw

To draw every two, three, or four hours is not conducive to the making of good lime. During these long periods, temperatures build up and the smaller fractions of the lime at least become overburned. Also, when drawing at such extended intervals, the rearrangement of surfaces is too infrequent. Some suffer excessive exposure to heat, others insufficient exposure.

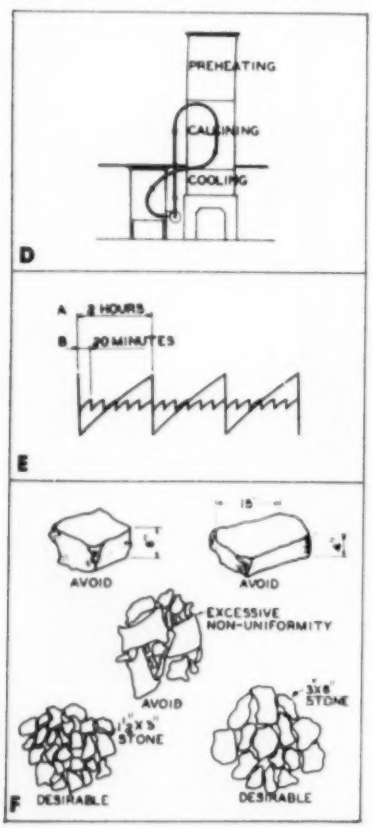
In view of this, the drawing should be at frequent intervals, from an hour down to possibly 10 min., which exactly depends on the size of stone and kiln system. Operating in this manner, the air from the cooler will be of a more constant temperature and the cooler will function more effectively, discharging cooler lime. If at all possible, kiln operation should be by "slip" rather than the "hang" method.

### Finishing Zone

It is not reasonable to assume that calcination should be terminated in a zone of highest temperature. This was not so in the old type kilns. In these kilns the air did not come through the cooler and there was a soaking action, which however, was not entirely satisfactory since some of the dissipating $CO_2$ of the core was reabsorbed in outer sections of the lump and furthermore all the sensible heat of the lime was wasted.

This new Azbe patented system is better as it involves a special additional kiln zone within the lime kiln,

(Continued on page 146)




Diagrams of temperature control factors, (D) to (F)

**(D) The calcining region, intra-zonal system of gas recirculation (patented) limits calcining zone temperature, equalizes combustible distribution and increases mass flow. If the gas producer is a part of the system, this method of recirculation completely prevents clinker forming, helps both producer and kiln, integrating them into a single unit**

**(E) When lime drawing is at 2 or 4-hr. intervals, kiln exhaust temperature, draft, air temperature as well as lime temperature from the cooler fluctuate widely as shown at "A." Frequent drawing of lime as at "B" equalizes all these factors. Resulting frequent heat absorbing rearrangement is also advantageous**

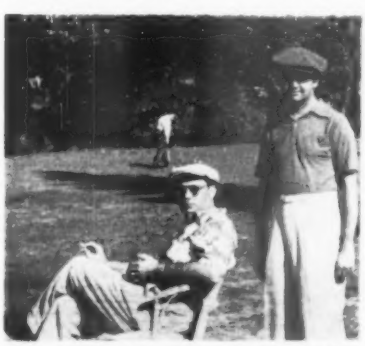
**(F) Kiln stone should not be selected according to size but to its calcining rate. Small sizes should be calcined separately. Stone of great thickness should be avoided as well as oversize jaw crusher slabs. Screens should have oblong rather than square openings as dictated by the Azbe stone chart. (see ROCK PRODUCTS, July, 1953, page 81). All stone should pass through a screen**

# Industrial Sand Producers Discuss Legislative and Engineering Problems

A GOOD ATTENDANCE for a semi-annual meeting greeted the officers of the National Industrial Sand Association at The Greenbrier, White Sulphur Springs, W. Va., at the opening session October 21. During the three sessions, October 21-23, some very important addresses and discussions covered the subjects of car supply, foundry sand specifications, abrasive sand competition, percentage depletion, traffic situation, and legislation.

President C. M. Hardy introduced Caleb R. Megee, vice chairman, Car Service Division, Association of American Railroads, as the first speaker at the opening session. Mr. Megee reviewed the car supply situation, and gave some interesting statistics pointing to the importance of the industrial sand industry as a user of freight cars. In 1952 the industry shipped 199,000 carloads as compared with an estimate of 207,000 carloads. Carloadings for the nation to date, he said, were running approximately 3 percent over the same period in 1952. The freight car situation is much improved with only spotty shortages reported. Railroads are striving for a goal of 1,850,000 freight car ownership. A heavy repair program has been under way involving 290,000 cars or nearly 21 percent of the total. The future car supply, he pointed out, is dependent on cooperation between users and the railroads by using cars to capacity and cutting down demurrage. Average car loading was 42 tons in 1952, and 17 percent of loaded cars were held beyond 48 hr. free time. There is no profit, he said, in demurrage.

Mr. Megee referred to changes in our national economy, particularly as they affect the railroads. The decline in coal mining, the Korean peace, and the annual increase of 2,500,000 in population are important factors changing the pattern of business. Mr. Megee said the railroads spend $1,200,000,000 annually. Geo. Thornton asked Mr. Megee about the capacity of freight cars today as compared with earlier periods. Mr. Megee said that the average capacity of cars was 53.2 tons in 1952 as compared with 47 tons in 1949. He pointed out that there are 33,000 covered hopper cars today which were not available in the past.



Arthur F. Harrison, left, resting up before teeing off with Gene Mason, right

E. M. Durstine, left, absorbed in conversation with E. C. Sawyer

V. P. Ahearn, executive secretary, brought up the cost of cleaning and repairing cars which is now being studied by the National Association of Shippers Advisory Council. He told about the survey made among members of the association which had been referred to the council.

## Engineering Problems

Stanton Walker, consulting engineer of the association, reviewed the problem of abrasive sand competition with slag grits and the studies which had been made in the association laboratory. Although it had been determined by the Industrial Hygiene Foundation that no free silica was present in slag grits, the grits have a greasy, adhering effect and have a less efficient abrasive action as compared with abrasive sands. Arthur Schlesinger reported that, under tests, the grits did not cover an area as large in a given blasting period as the abrasive sands and the loss for grits was twice as much.

Mr. Walker read the report of the association's laboratory test, using three slag grit products compared with Ottawa sand, in a range of No. 20 to No. 30 size, and a natural quartz sand in the No. 12 to No. 16 size range. All tests were made in a one-third scale model Los Angeles Abrasion machine. The Ottawa sand had the lowest losses of all the materials tested.

On the question of foundry sand grading, Stanton Walker referred to a letter which he had received from Mr. Sanders of the American Colloid Co., on the question of improvements in the American Foundry Society's grading specifications. It is now the practice to define sand grades as No. 1, No. 2, etc., based on the number of passages through designated screens. It is proposed to set up new standards including other factors. A committee was appointed to go over the problem with Mr. Walker. The following were named to this committee: E. C. Sawyer, Robert J. Maddison, Geo. Pettinos, Jr., W. D. Chadwick, Geo. Thornton, and Wm. J. Cannon. Other foundry sand producers also were invited to sit in at the meetin. On the subject of packaging developments, he said that it is largely a matter of good house keeping and keeping abreast of machinery developments.

## Foundry Sands From Users' Standpoint

Earl E. Woodliff, Foundry Sand Service Engineering Co., was introduced as the first speaker at the Thursday morning session by Clarence Wolf, vice-president, who presided.

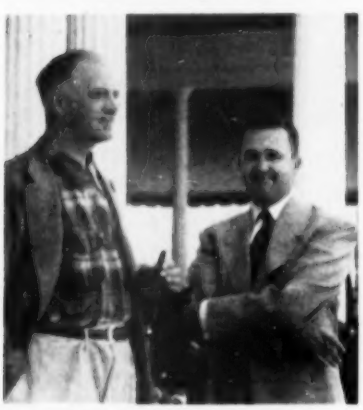
Mr. Woodliff, in his opening remarks, suggested closer collaboration between the foundry industry and the sand producer. Most troubles of foundrymen, he said, are due to the small percentage of additives rather than the sands. He urged sand producers to suggest to foundrymen the employment of an outside engineer to give unbiased information in solving foundry sand problems. He said foundrymen will spend thousands of dollars for equipment, but will be reluctant to hire an engineer to improve his sand control. Troubles may

Stanton Walker, who wore the look of a frustrated golfer, standing alongside smiling Mrs. Walker

Watching the golfers tee off may be seen C. M. Hardy, R. D. Muhlitner, and Earl E. Woodliff who was one of the speakers

Wm. J. Cannon wears a startled expression, left, while Chas. Gorsuch takes a serious view as he prepares to tee off

Mr. and Mrs. A. Warsaw sampling the sunshine near the golf course



Nanko C. Bos, left, with Gene Mason

be due to several causes, but the sand producer is often made the goat for mechanical problems. Uniformity and quality are expected by foundries, but no sand is universally accepted. Ninety different grades, he said, are used in the core room alone by the malleable steel castings industry. Eighty percent of the malleable steel foundry industry use at least two or three core sands. He predicted that producers will be compelled to custom blend sand for foundrymen; in other words, prepare a prescription sand.

On the question of sand grain distribution, Mr. Woodliff said that it does not make much difference if it is No. 1 or No. 5; the determining qualities are expansion and contraction behavior and ram density. He pointed out that sands vary as much as 20 percent in weight. Better density, he said, could be obtained by blending back.

Mr. Woodliff showed several samples of sand which had been subjected to the 10-min., 2500-deg. F. test. He said that expansion causes most of the trouble. High expansion is not so bad in itself, but high contraction causes buckling. Additives, he pointed out, control this characteristic, particularly for gray iron or malleable castings. Sea coal and pitch are the most effective. Finer sands and high $SiO_2$ create high expansion, and materials added to the sand often cause an increase in fines. However, the lack of fines, in striving for permeability, is causing present day troubles with rough castings. Steel foundries are having trouble due to lack of sand density. He pointed out that density can be obtained in two ways; by adding coarse grains, plus 50 mesh, and increasing fines (silica flour).

On the relative merits of synthetically or naturally bonded sands, the economy usually determines use, such as freight rates, etc. Natural sands are more dense as an average. Fire clays give better density than bentonites. A clay content of ½ percent is most successful for core sands, he said, and natural molding sand should carry a clay content of 11 to 14 percent with a saturation point of 16 percent. Mr. Woodliff gave his interpretation of the four A.F.S. classifications for foundry sand. He expressed the belief that tests should only include the grain size and not the clay. Steel foundries, he said, are considering the silica content as a more important factor. Silica flour is coming into greater use to gain hot strength. Additives provide a softening point, approximately 2000 deg. Vinsol resin also is being used. Mr. Woodliff said that foundrymen would like to have a simple specification chart of the sand producer's products so that he could select what he wants.

## Traffic Matters

William W. Collin, Jr., reviewed the current negotiations of foundry and pulverized sand freight rates. Ground sand rates are now on a 120 percent relationship with standard sand rates. An attempt is now being made to get the ground sand rate down to a 110 percent relationship with standard sand rates. Mr. Collin told about the appearance of Mr. Devine and Mr. Roy in the hearings on this case, and the work they have done. Emory Durstine discussed the possibility of setting up a traffic committee to handle the situation involved in this case if litigation should develop.

## Legislative Developments

Ted Waters, association counsel, reviewed the insurance rate situation, legislation, and compensation for hearing impairment. Mr. Waters told about the work of the Rock, Sand and Gravel Producers Association of California in having set up a code classification in which silica grinding comes under classification 1741. There has

Looking toward head of table at "get-together" dinner where the officers were seated

been a substantial reduction in rates as a result of this educational work on the part of this association. Mr. Waters has prepared a chart giving insurance rates covering producers in all states which he will make available to members. Two states, he said, have enacted occupational disease legislation; namely, Oklahoma and Kansas. In the case of Oklahoma, there has been an increase of 50 percent in rates attributable to this new legislation. Oklahoma has limitation of liability.

Noise in industry is becoming an increasing factor in compensation claims, said Mr. Waters. Claims pending in the Middle West and East are growing rapidly. He cautioned members to be alert to operations which might lead to claims of this kind.

### Percentage Depletion

John T. Sapienza, tax counsel, briefly referred to the reorganization of the Bureau of Internal Revenue, which is now known as the Internal Revenue Service. Under the new administration, there will be greater decentralization. There is a changed attitude; more settlements can be expected and agents have been instructed not to raise unnecessary issues. They are trying to get away from review functions as much as possible and introduce more enforcement, but new sources of revenue are being sought.

Turning to the question of percentage depletion, Mr. Sapienza said that several new additions have been made to those applying for percentage depletion, including gypsum and kyanite. He expressed the belief that the revised bill introduced by Rep. Bennett of Florida had little chance of passage. The original bill reduced all depletion allowances from 15 percent to 5 percent, but later revision left the 15 percent in and the other rates remained the same.

Legislative hearings have been scheduled on 40 topics, including percentage depletion. Industrial sand, crushed stone, slate and gypsum industries have asked for inclusion of 15 percent depletion rates. The talc industry has asked to be included in category 4 (to include grinding).

Mr. and Mrs. Edward Shaw and Miss Mary Zongaro

Proposals have been made (1) to include all properties under depletion, and (2) to include all properties, but they must be operated as one unit. Another proposal is that stockholders be given the benefit of percentage depletion on dividends in proportion to the rate granted to the company. Optional depreciation periods on machinery is another proposal under consideration.

Regulations of the Internal Revenue Service were released in July. Quartzite was given 15 percent depreciation and sand 5 percent. A refractory brick company made an appearance before the bureau officials requesting 15 percent percentage depletion for refractory clay and quartzite. A differentiation between quartzite and silica was set up as a breakage across the grain. The problem is one of persuading the technical people in the treasury department. The next alternative is to take the case to a tax court. Revenue ruling 184, covering taconite, recognizes pulverization and thermal action as essential to make the product suitable for shipment.

The next annual meeting on April 20 to 22, 1954, will be at Boca Raton, Fla. The 1954 fall meeting will be at the Hotel Plaza, New York, N.Y., October 20-22. It is planned to set up a five-year program of meetings. The 1955 meeting will return to the Greenbrier, White Sulphur Springs.

J. M. Strouss, president of Deckers

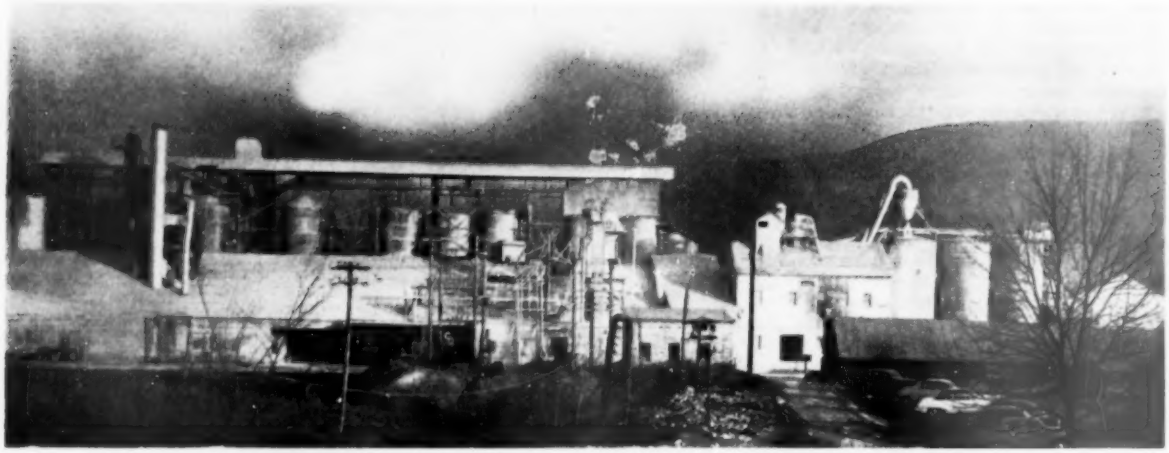
*(Continued on page 150)*

George F. Pettinos, Jr., left, emphasizing a point to Caleb R. Magee of the Association of American Railroads, one of the speakers

Mr. and Mrs. Marcus S. Wright, Jr., relaxing near the golf course

C. M. Hardy and V. P. Ahearn opening the first session of the fall meeting

Mr. and Mrs. Arthur Schlesinger



Broadside view of lime plant which has been operated by four generations of the Deely family

# Complete Hydration of Lime Without the Use of Autoclaves

**Lee Lime Co., Lee, Mass., installs new type non-pressure hydrator for the effective hydration of lime at a high rate of production. Hydrate exceeds A.S.T.M. requirements**

SEVERAL WEEKS AGO, the Lee Lime Corp., unveiled at Lee, Mass., a new type hydrator installation which is expected to be of far-reaching importance to the lime industry. The hydrator was developed by Kennedy Van Saun Mfg. & Engineering Corp., with the collaboration of John Gaisford, chief chemist of Lee Lime Corp., and Prof. J. A. Murray of Massachusetts Institute of Technology. The new equipment was designed expressly to produce a thoroughly hydrated dolomitic or calcitic lime without recourse to pressure hydration.

A novel feature of his hydrator is the use of a method of heat exchangers to obtain heat control, together with the use of mass reaction. The method of heat control and heat transfer enables the hydrator to be started up in the coldest weather and to produce a perfect hydrate almost immediately. This is a valuable asset, particularly when, as often is the case, continuous use is not possible. If any breakdown or other stoppage occurs in the plant, the hydrator can be stopped and restarted without damaging the material undergoing hydration.

By utilizing the large mass of material, it helps to blend it for uniformity of product, and due to its method of construction even quite hard burned lime may be used mixed with fast lime without affecting the product.

In over three months of full-scale operation, the new equipment has hydrated virtually 100 percent of the magnesium content of the feed. Ignition loss of the end product normally runs 27 to 28 percent. Operating reports indicate all of the hydrate produced has been of uniform quality. Its subsequent expansion is of a very low order of magnitude because of the complete hydration of the magnesium content in the quick lime.

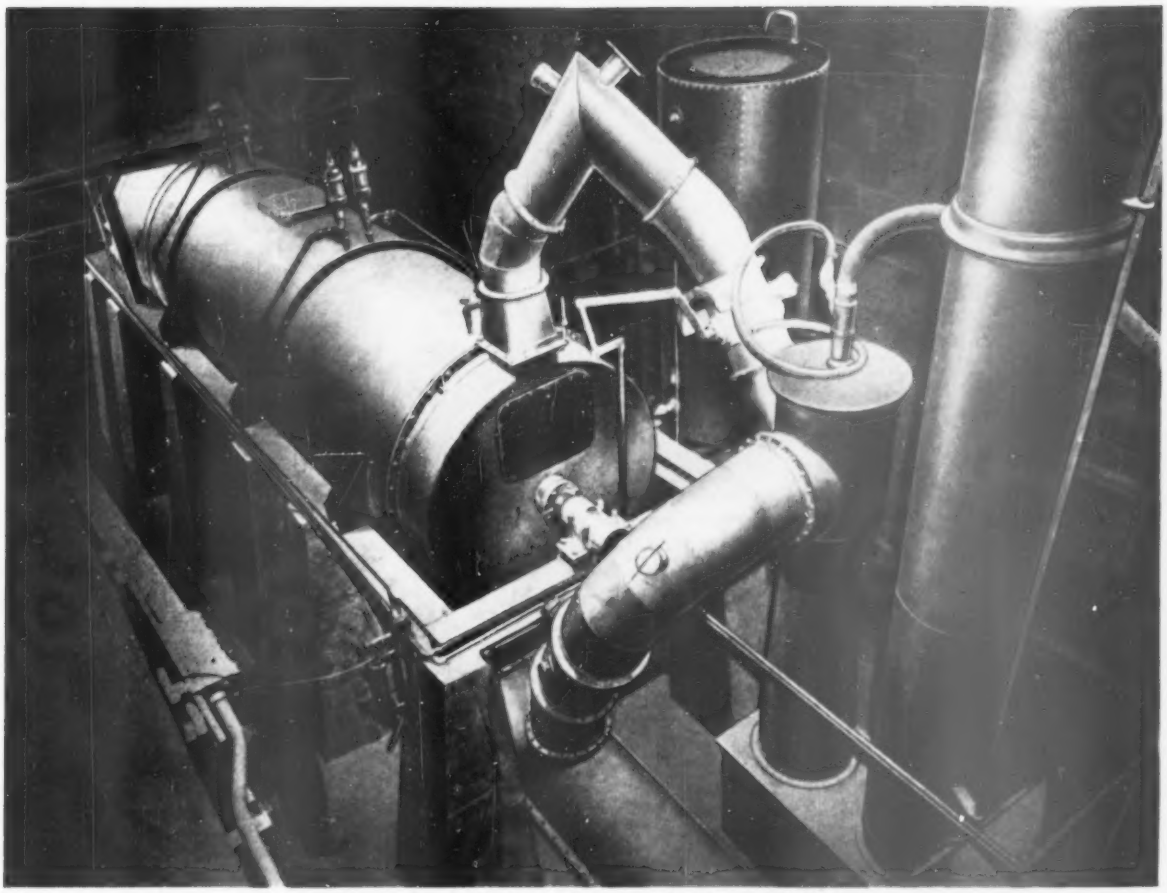
From the standpoint of capacity, the hydrator has exceeded the designers' expectations, due to the speeding up of the process in the mass reaction which increases the hourly output.

Left to right: J. M. Deely, Jr., vice-president; Norman Simpson, advertising manager; and J. M. Deely, Sr., president

## Method of Operation

The quick lime is ground for hydration and fed into the hydrator circuit by means of a Poidometer so that all of the material is accurately weighed. This continuous weighing device discharges onto a belt conveyor which in turn feeds a high-speed mixer. The milk of lime is introduced at this point after passing through a Rotometer to assure the desired proportion of water to weight of lime. The material is mixed and fed to the hydrator as quickly as possible in order to complete this stage before the sticky phase of the reaction develops.

Plow-like paddles inside the hydrator have just enough inclination to cause a gradual movement of the mass from the point of entry to the discharge end of the unit. Their only other function is to keep the material from sticking to the walls of the hydrator. Time of retention runs about an hour in the Lee installation; this factor is controlled by the setting of an adjustable dam at the discharge end of the hydrator.



Close-up of non-pressurized hydrator for dolomitic or calcitic lime

Although this installation was initially conceived as a pilot plant, all of the facilities were designed by Kennedy Van Saun on a full-production basis, and it is noteworthy that the plant has produced marketable material almost from the first hour it was placed in operation. Various tests show water retention ranging from 92 to 95 percent in the finished product, and the hydrate produced has evoked considerable favorable comment in connection with both masonry use and finish coat work.

## Operating Data

Operation of the hydrator was started on August 3. At the end of a week, it was producing type S dolomite hydrate without the use of pressure, according to a report by A. R. Allen, engineer for Kennedy Van Saun. Dolomite quick lime was fed to the hydrator at a rate that would produce approximately 5 tons of hydrate per hour, the capacity for which it was designed. By the end of a week, adjustments had been made so that it was possible to increase the feed to an amount equivalent to 6 tons of hydrate per hour. After increasing capacity, a sample was analyzed, revealing that more than 98 percent of the quick lime had been hydrated and the quality of the lime both as to plasticity and water retention exceeded the government specifications. With this excess hydration over the government specifications, which call for a maximum of 8 percent unhydrated oxides and a minimum plasticity of 200, the Lee Lime Corp. will have a wide factor of safety in their final product to meet the most exacting specifications for the users of hydrated dolomitic lime. It is anticipated that it is quite probable to increase capacity over the 6 tons per hour rate when other equipment connected to the hydrator is modified. The hydrator installation is housed in a new addition to the existing structure.

John Gaisford, chief chemist of the company, in reporting on laboratory tests which were conducted in collaboration with Prof. Murray, pointed out that current type S specification was exceeded from the beginning of operations. Unhydrated oxide content has been reduced to less than 1 percent. The hydrator has handled remarkably well varying degrees of burning in the quick lime fed to it while still producing a good even product. This has been accomplished due to the method of hydration with a heat exchanger as the overburned and therefore slow to hydrate oxides, being heavier than a hydrate, are automatically retained longer in the hydrator before passing over the outflow dam and thereby are completely hydrated. In fact, the outflow dam had to be cut down 18 in. as more hydrate would have been made than the plant could handle.

Plasticity of the product has been very satisfactory. It was at first thought that it would be necessary to install a tube mill to get the plasticity desired, about 350 Emley, but it was possible to achieve this with the existing Raymond Imp mill. This is accounted for by the temperature control of the heat exchanger. Reports show that the non-pressure hydrator exceeded the A.S.T.M. specifications for water retention in the hydrate which calls for 75 percent water retention for type N, and 85 percent for type S.

Further tests have indicated the following data obtained in duplicate runs:

| | | |
|---|---|---|
| Wt. Lime | 500 | 500 |
| Wt. Ottawa Sand | 1500 | 1500 |
| Wt. Water | 475 | 475 |
| Initial Flow | 113 | 112 |
| Flow After Suction | 107 | 103 |
| Water Retention | 95% | 92% |

It is entirely feasible to operate all of the facilities with just one man.

View of quarry showing shovel loading truck. Note the interesting stone formation

By the use of this method of unit construction, the hydrator is flexible for fitting into various designs of plant layout. It also enables the correct sizes of high speed mixers, dryers, etc. to be assembled for use either to hydrate high calcium or dolomitic limes.

Several years ago, the Lee Lime Corp., completed a major improvement program which included the installation of a 7½ x 125-ft. Kennedy Van Saun rotary kiln equipped with the latest design preheater and deheater to replace their old vertical kilns.

Officers of the company are John M. Deely, Sr., president, and John M. Deely, Jr., vice president. This successful father-and-son team represents the third and fourth generations of this family's operations in the lime industry.

## Industrial Hygiene Meeting

THE INDUSTRIAL HYGIENE FOUNDATION held its 18th annual meeting at the Mellon Institute, Pittsburgh, Penn., November 18-19, 1953. Among the speakers at the conference was V. P. Ahearn, executive secretary, National Sand and Gravel and National Ready Mixed Concrete Associations, who gave the keynote address, "The Role of Government in the Employer-Employe Relationship."

Other program topics included the following: Industrial Noise—A National Problem; Problems of Human Relations in the Industries; The Proper Scope of Medical Care in Industry; Problems Associated with Older Workers; Compensation for Residual Disability; Review of 1953 Legislative Changes in Statutes Providing Compensation for Occupational Diseases; Value of Pretrial Conferences in Compensation Cases; The Meaning to Management of the Problem of Industrial Noise; Legal Interpretation of Limitation Provisions in Compensation Statutes; Analyses of Biological Materials as Indices of Exposures to Hazardous Materials; Mechanical Arrangements for Controlling Dust and Fumes; Principles of New Plant Design for Health Protection; The Granular Filter for Dust and Furnace Fume Collection and Cleaning of Wet Corrosive Gases; Dust Control Developments in Asbestos Screening Operations and Jute Bag Storage; and Control of Dust in Rock Crushing.

Also included on the agenda was a panel discussion on "Administration of Workmen's Compensation Laws," in which E. T. Andrews, vice-president, Pennsylvania Glass Sand Corp., was a panel member.

## N.C.S.A. Safety Competition

THE BAKERTON UNDERGROUND LIMESTONE MINE of The Standard Lime and Stone Co., Bakerton, W. Va., won the highest safety honors in the 1952 National Crushed Stone Association Safety Competition, as reported by the Bureau of Mines. The Bakerton operation won the bronze plaque provided by the *Explosives Engineer* magazine, for operating 177,946 man-hours during 1952, without a lost-time disabling injury. In addition, each employe was awarded a symbolic certificate by the National Crushed Stone Association, in recognition of his individual part in achieving this safety record. During the six years of its participation in the competition, the mine has operated 744,888 man-hours with but six lost-time injuries and 219 days loss of injury disability.

The Security limestone quarry of North American Cement Corp., Hagerstown, Md., ranked second in the 1952 competition, working 169,133 man-hours without a lost-time injury. The North Branford No. 7 trap rock quarry of The New Haven Trap Rock Co., North Branford, Conn., won third-place safety honors with its accomplishment of 129,945 man-hours of safe operation.

The injury experience of the 42 plants enrolled in the 1952 contest, although not as favorable as in 1951, was still one of the best in the 27-year history of the contest. The injury frequency rate in 1952 of 21.193 per 1,000,000 man-hours of work was lower in only six of the past contest years. The injury severity rate of 3.514 days per 1000 man-hours of operation was the sixth lowest in the history of the competition.

Of the 42 competing plants (36 open-quarry operations and six underground mines) 10 had injury-free records, working an aggregate of 945,421 man-hours, or 15 percent of the total worktime of all 42 enrolled plants. In addition to the plants previously mentioned, the following plants also had injury-free records:

White Haven quarry, The General Crushed Stone Co., White Haven, Penn.; 95,186 man-hours.
Rock Hill quarry, The General Crushed Stone Co., Quakertown, Penn.; 80,518 man-hours.
Stephens City quarry, M. J. Grove Lime Co., Stephens City, Va., 70,440 man-hours.
Jordanville quarry, The General Crushed Stone Co., Jordanville, N.Y., 68,939 man-hours.
Cedar Hollow quarry, Warner Co., Devault, Penn., 62,167 man-hours.
Wallingford No. 1 quarry, The New Haven Trap Rock Co., Middlefield, Conn.; 59,410 man-hours.
Prospect Stone Plant No. 6 quarry, Eastern Rock Products, Inc., Prospect, N.Y., 31,737 man-hours.

## Feldspar Expansion

INTERNATIONAL MINERALS & CHEMICAL CORP., Chicago, Ill., has started a wide-range expansion program of its Consolidated Feldspar Department in the Industrial Minerals Division, according to an announcement by Norman J. Dunbeck, vice-president in charge of the division.

In addition to planning three new plants, existing equipment is being enlarged and modernized. Power equipment, such as shovels, bulldozers and trucks, is being replaced with new and larger units. Dust collecting and water clarification systems are also being installed.

Flotation capacity of the Spruce Pine, N. C., plant has been increased by 50 percent, while new fine-grind facilities have been installed at the Erwin, Tenn., operation. The main quality-control laboratory at Kona, N. C., has been revised and enlarged, and new research projects have been started for the feldspar department by the company's research division, with two other such projects having been assigned to outside laboratories.

Of the new plants to be established, one is to be located on the company's extensive feldspar reserves in southern Connecticut. Diamond drilling has already been completed, and plans are now being drawn for a plant which will probably employ the LeBaron-Lawver dry-beneficiation process.

Diamond drilling is also underway on International's nepheline-syenite properties in southern Ontario. A processing plant to process these materials will be built at Blue Mountain, Ont., and is expected to be in operation by mid-1954. A third large unit, a feldspar plant, will be constructed within about a year, at an undisclosed location.

# INSERTED CONSTRUCTION In Rotary Kilns

By B. M. PEARSON

ALMOST AS OLD as the rotary kiln itself are the attempts to reduce its thermal consumption to a reasonable figure. The rising price of fuel since the war has added still greater impetus to this quest.

The basic reason for high thermal consumption lies, in the main, in the utilization of only 7 to 15 percent of the cross section, which does not afford satisfactory thermal transfer so long as the material moves in a relatively small segment of the kiln within a constricted path; in that case the hot combustion gasses passing over only come into surface contact with the material. Also, the heat given off to the kiln lining by radiation and conduction has only an intensifying effect on the surface of the material.

It is known that the rotary kiln, when running typically slowly, is an extremely poor mixer so that material circulation for more rapid contact of hot gas and material occurs to a strictly limited extent. The actual effect in the kiln is more that of the material rolling in a constricted path on the surface of the mass. Accordingly, other methods have been applied, e.g., longer kilns, in order to induce adequate heat transfer throughout the whole material.

A lengthening of the contact time between the hot gases and the material, achieved by slowing down the progressive movement of the material by reducing the rotation rate of the kiln, tends to give poorer rather than better mixing. It also reduces output. Lengthening the contact time by lengthening the kiln itself, which reaches its practical limit in large units 100 to 120 meters long (328-394 ft.) certainly does give a longer contact time between the material flow and the hot gas with the same material travel speed. However, this can by no means be regarded as the ideal solution. Lengthening the kiln increases the kiln mass and the absolute surface. Increasing the kiln mass means, however, higher power consumption, higher lining charges and higher depreciation. Increasing the kiln surface means increasing the radiation to the outside, so that the desired effect of reduced fuel consumption may become illusory.

If it is desired to provide more surface as a basis for increasing thermal transfer possibilities, it is obvious that only internal surface should be increased and that increasing external kiln surface must be avoided. This method again is not new and has been tried experimentally for a long time, and with good results. Installation of internal chain systems in practically all the larger kilns today provides the feed end with a curtain arrangement. The suspended chains increase the surface area. They absorb a part of the heat of the stream of hot gases and return this to the material in which they are immersed. Simultaneously they increase the material path and by this means insure better thermal penetration.

Unfortunately, this proved system can only be applied to those parts of the kiln where no very great degree of heating is attained; that means it finds use only in the material drying stage. In the kiln location where the greatest fuel consumption is, i.e., where the actual reactions take place, whether this be in the calcination of cement, lime or magnesite, this process is no longer applicable, as the degree of heat in these parts immediately scales or burns away chain installations.

It is only ceramic construction parts which can lead to the desired objective in these parts of the kiln, but a freely moving arrangement similar to the chain system is impossible to achieve using such materials. It is necessary to seek other ways, and in this matter experience which has been gained with cylindrical dryers can be drawn on. Thus, just as is done with the cellular type of cylindrical dryer, the kiln cross section is divided into chanelled zones, a method which can be accomplished by using ceramic construction materials.

Two objects are achieved by this. First, the internal kiln surface area is considerably increased, and by this means a better thermal utilization is obtained because the internal surface area, to a certain extent, can be regarded as a therma! accumulator which first extracts the heat from the hot combustion gas and then passes this back to the kiln feed by means of radiation and conduction. The greater the capacity of this accumulator, i.e., the greater the available area for heat absorption and subsequent emission, then quite naturally the greater is the effect obtained.

Second, the channel-like layout divides the material flow into a number of material paths corresponding to the number of channels. Since this takes place with the same amount of feed as in kilns without the channel subdivision, these multiple material paths are correspondingly thinner, so that they become better heat transfer media.

As compared with the channelized construction of rotary dryers, sections of which are made of thin sheet steel which does not appreciably reduce the useful effective kiln cross section, ceramic inserted channel sections do affect the cross sectional area because of the greater wall thickness required. This in turn increases the velocity of gas through the kiln, which in no way diminishes the desired useful effect, however. In addition, as will be shown, there are means for compensating for this.

Previous work in this direction by V. J. Azbe may be cited here. This worker studied the problem of ceramic inserts in rotary lime kilns much as outlined above. From these studies it would appear his conception of the installation of ceramic crosses for cross sectional division of the rotary kiln is something absolutely new. These conceptions are disputed by Zollinger, however. It is pointed out that rotary kilns of the type mentioned have been in use in Germany in various branches of industry for years and the practical application of the idea of ceramic inserts has been known for a long time.

Some 30-35 years ago, Zollinger states, he conducted tests on burning of phosphate to develop a design of this type, although practical operation was not entirely satisfactory because suitably shaped brick for its construction were not available. R. Dietze later provided the solution to this problem; his method was subsequently patented in most countries.

Four kilns designed according to these patents, which incidently are held by Didier-Werke A.G., Germany, were used on the gypsum-sulfuric acid process for many years and have given good service. In addition, kilns of this type have been installed for the roasting of pyrites and bauxite, as well as for cement burning.

The cross-type of unit developed by Azbe, which subdivided the kiln cross section into four channels, can be compared with the unit developed by Dietze which divides the kiln into three channels. This appears to be a better design and fulfills its purpose completely. Calculation shows that the Dietze unit gives a kiln surface of about double, and a surface increase of the amount of material divided into the three flow paths of about 2½ times, that of the undivided flow in standard kiln construction. It is clearly obvious that quite appreciable improvement of the heat-transfer effect becomes possible by this means.

To this can be added the fact that these ceramic inserts can be installed practically up to the sintering zone,

(Continued on page 150)

Left: Diesel engine drives the primary crusher section of this portable plant at Jamesville, N.Y.

Right: Two vibrating screens, a triple-deck 4- x 10-ft., and a double-deck 4- x 12-ft., are mounted over truck bins at Jamesville, N.Y.

# PORTABLES
# Supplement Stationary Plants

**The General Crushed Stone Co., Easton, Penn., is operating portable crushing and screening plants at Glen Mills, Penn., and Jamesville, N.Y., to increase efficiency**

PORTABLE PLANTS are being used to supplement stationary plants of The General Crushed Stone Co., Easton, Penn., an old and established crushed stone producer with operations centered around some of the larger cities in New York and Pennsylvania. Combined capacity of the company's 10 crushed stone operations is in the 24,000 tons per day range. In addition, the company operates two sand and gravel plants, three agricultural limestone plants and bituminous concrete plants at all but one of the operations with three additional bituminous concrete plants that operate independent of any aggregate production facilities, or a total of 18.

About three years ago the company installed a portable plant at their Glen Mills, Penn., operation and more recently one at Jamesville, N.Y. The Glen Mills crushed stone operation is one of the company's larger operations, and is located a few miles to the west of Philadelphia. It is a trap rock with most of the production coming from the older crushing and screening plant.

With the gradual increase in portable plant operating efficiency, the engineering and operating staffs of the General Crushed Stone Co. saw a possible use of this equipment at the Glen Mills quarry. Quarry practices were therefore modified to obtain a higher production rate and to get a cleaner product. In essence, the top strata of rock from the quarry, after removal of dirt strippings, is sent to the portable plant, and the lower strata goes to the older stationary plant. The portable plant produces large and small ballast, road stone (crusher run), screenings, and ¾-in. stone. It has produced upwards of 167,000 tons of commercial stone.

The portable used is a Cedarapids unit with a 25- x 40-in. primary jaw crusher and a 10- x 36-in. secondary unit, both roller bearing. There are three screens in use; all double-deck units although only one deck is now in use. The first screen is a 4- x 12-ft. Symons, the second a Cedarapids, and the third another Symons. For loading in the quarry, there are available a 3-cu. yd. Lima equipped with a Cummins diesel and a 2½-cu. yd. Northwest that uses a Murphy diesel. These shovels load to a fleet of Euclid trucks that deliver to the portable plant located on the brow of the quarry above and opposite the stationary plant. The portable operates dry and has a nominal capacity of 80 t.p.h.

A 14- x 22-in. triple-roll crusher at Jamesville, N.Y.

Left: Primary and secondary crushing sections of portable plant

Right: Close-up of the primary crusher set-up at Glen Mills, Penn.

Harry McGuirk is superintendent at Glen Mills, and Chas. Raub is foreman in charge of the portable.

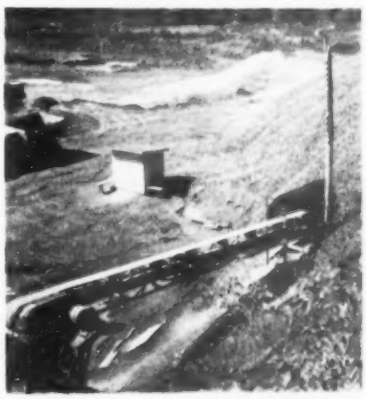
The second portable used by the General Crushed Stone Co. is a Pioneer plant which was intended to shuttle between the LeRoy and Oaks Corners plants, and to process any stone that economics might indicate as being advisable. However, it was recently sent to the Jamesville, N.Y., plant where it has worked out so successfully that it is apt to remain there indefinitely.

At Jamesville the Allied Chemical and Dye Corp., Solvay Division, operates a large limestone quarry and processing plant, but under present conditions does not normally produce a sufficient quantity of small sizes to meet the market requirements. The General Crushed Stone Co. processes the larger material in the portable plant to produce smaller sizes of commercial stone.

The portable plant is located about 1½ miles from the Solvay plant and alongside the older permanent operation of the General Crushed Stone Co., that at present is not being operated. A contract hauler delivers the No. 3 stone to the portable plant in a fleet of two axle-trucks, which unload over a reclaiming tunnel belt conveyor serving the portable set-up.

The Pioneer plant uses a 14- x 22-in. triple-roll crusher powered by a Murphy diesel. There are two sets of screens; a 4- x 10-ft. three-deck unit and a 4- x 12-ft. three-deck screen. However, on the latter screen only two decks are used. The plant operates dry, and has a nominal capacity of 80 to 90 t.p.h. when preparing No. 2 stone, a minus 1⅛-in. product. Current material is collected in steel portable bins with the excess production going to ground storage via stacker belts. Reclaiming from ground storage is by means of a Lorain shovel and a Haiss loader. The plant is about two years old and has processed in excess of 200,000 tons of material, all of which is trucked by independent haulers into the Syracuse, N.Y., area. The plant is located about 1½ miles from the south boundary of that city.

At the throat of the reclaiming tunnel conveyor a magnet has been installed for removal of tramp iron. It is suspended over the belt conveyor in such a manner that the assembly



The minus 3-in. stone from the Solvay plant is reclaimed and sent to the portable plant at Jamesville, N.Y.

can be swung to one side to more easily remove any tramp iron. The reclaiming belt conveyor is fed by two gravity gates and one Jeffrey vibrating feeder. Electric power for all incidental motors is from a D-17000 Caterpillar diesel-electric plant. All shipments are weighed on a set of Howe truck scales. M. H. Alderman is superintendent of the Jamesville operation and Wilson Pickard, foreman. Oscar E. Benson is president, M. Boree, general superintendent, and E. E. Dotter, assistant general superintendent of the General Crushed Stone Co. with offices in the Drake Bldg., Easton, Penn.

## Develops Grinding Mill

JAMES L. BRICKLEY of Spokane, Wash., recently developed a fine grinding mill with a stationary inclined floor section and a movable vibrating section. The hopper at the top of the mill drops ½- to ¾-in. material onto a vibrating rubber apron feeder, which then drops it into the mill intake. A series of parallel cutting bars is hammered several hundred times per minute against the inclined floor, crushing the stone to the desired mesh, which is controlled by regulating the incline of the mill floor or the amount of water introduced into the mill along with the crushed stone. A patent for the grinding mill was applied for in March, 1951.

Overall view of portable plant at Glen Mills, Penn., showing truck loading bins in foreground

# Ideal's New Research Center

*(Continued from page 101)*

ing the modulus of elasticity by the so-called "sonic" method. This apparatus measures the natural frequency of vibration of concrete cylinders and prisms induced by a driver, coupled electronically to a pickup device. As the specimen deteriorates as a result of the alternating freezing and thawing effects, the reduction in the vibration frequency then provides a quantitative measurement of the extent of the breakdown. Obviously, the use of this equipment permits repeated observations of any specimen without destroying it, as would be the case if it were subject to either destructive compression or flexural testing methods. Since natural freezing cycles have a profound effect on the durability of concretes in service during normal winter weather, such laboratory studies are extremely informative in predicting the behavior of concretes under these conditions.

Interest in concrete durability is obviously not confined entirely to changes in the internal structure which occurs during a severe winter season, since this problem is pretty well solved by the proper addition of air-entraining agents. We are also confronted with the behavior of concretes subject to alternate wetting and drying, and heating and cooling cycles, where the temperatures involved are above the freezing point of water. In order to study this other type of environment, the department is provided with a cabinet which is controlled with respect to the aforementioned four variables. Structural alterations caused by this treatment manifest themselves in volume changes which can be very accurately determined by a number of different kinds of length comparators available for this purpose. Incidentally, since alkali-reactive aggregates are particularly susceptible to adverse reactions under these conditions, this affords a ready means of evaluating such materials in relation to concrete durabilities.

The presently available equipment and the functions they perform in supplying the answers to the many problems which this department is called upon to solve may, and probably will, be inadequate with the advent of time and increasing complexities of experimentation. Such investigations usually require apparatus specifically designed for the task at hand, which is rarely available in the final form from technical supply houses. Therefore the Research Department is provided with complete machine, woodworking, and sheet metal shops to manufacture equipment to fit the job. One very proficient instrument maker is, even at this early stage, constantly engaged in the fabrication of such special designs.

It is not the intention of the Research Department to delve into basic research any more than is required to solve the many puzzling situations which face the Ideal Cement Co. Such studies had best be left in the hands of research organizations such as the Portland Cement Association, National Bureau of Standards, and the various colleges and universities throughout the world interested in this kind of experimentation.

Much information is available covering the fundamentals of cement manufacture and use, but also some questions still remain unanswered. It is the responsibility of this department to keep abreast of all new developments and apply these data to the problems which confront this organization, but it is extremely difficult to analyze some of them simply from the standpoint of applied research, and many solutions will thus be incomplete without entering the field of the more basic types of investigations.

Therefore, while the activities are rather clearly defined with respect to purpose, nevertheless it is obvious that basic research, limited in scope, must of necessity at times inject itself in to the picture. It is primarily for this reason that the personnel of this department has been carefully selected so that included therein will be found scientists, well trained along highly specialized lines. Without them, all the fine equipment and otherwise adequate facilities would be of but very little help in surmounting the many complex problems which presently confront this company and which will become increasingly complicated as the uses of cements expand and the specifications become possibly more restrictive during the years to come.

R. F. Blanks, research consultant, Harold E. Hosticka, laboratory manager, and Kenneth E. Palmer, assistant to the director of research, form an able consultation staff in designing laboratory procedures for the solution of problems at hand.

## Ilmenite Plant

A NEW $3,000,000 MINE AND PLANT to produce ilmenite has been announced by E. I. du Pont de Nemours and Co. The plant, which will be known as the Highland plant, will be located near Lawtey, Fla., about 17 miles north of the company's Trail Ridge ilmenite plant. Construction of the plant is to start immediately and production is expected to begin early in 1955. The plant will be built and operated for du Pont by the Humphreys Gold Corp. of Denver, Colo., as in the case of the Trail Ridge plant. Humphreys will also provide some of the major equipment.

The new operation will be similar to the Trail Ridge plant which was described in ROCK PRODUCTS, December, 1951, issue, p. 92.

The percentage of ilmenite in the sand at both the Trail Ridge and Highland deposits is quite small; for every two tons of ilmenite recovered, it is necessary to dig out about 100 tons of sand, compared with deposits being mined elsewhere which run up to 75 tons of ore per 100 tons of material handled.

Ilmenite is the principal titanium-bearing ore available to industry. Since 1948, du Pont has been pioneering the commercial development of titanium in its metallic form, which reportedly is becoming one of the important structural metals vital to the government's defense plans and thus is being developed at a much faster rate than usual for a newly produced metal. Previously, the major importance of ilmenite was its source for titanium oxide, or snow-white pigment used widely in the paint industry.

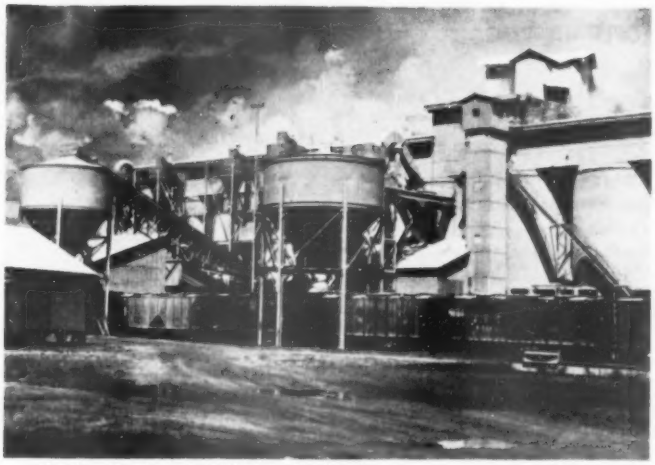
## Cement Plant Expands

SOUTHWESTERN PORTLAND CEMENT CO. is expanding its facilities at Victorville, Calif., with the addition of a $130,000 feed end building and kiln foundation.

**Quarry strippings are being used by Kentucky Light Aggregates, Inc. to build a dam for fresh water conservation purposes**

# Largest Pulverizer in Florida Phosphate Field

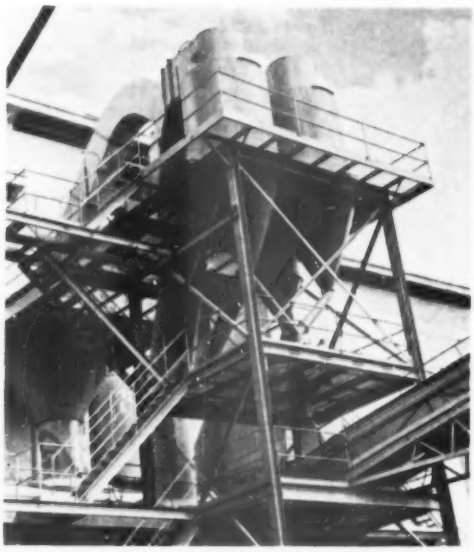
## ...Doubles Production for Pierce, Florida Plant of The American Agricultural Chemical Co.!



The American Agricultural Chemical Co. Grinding Plant - Pierce, Fla.

The American Agricultural Chemical Co. found it necessary to double the grinding facilities of their Pierce, Fla. operations. After a careful study of available systems, the Kennedy Air Swept Ball Mill System was chosen as the one best suited to grind pebble, concentrate, or a combination of both at the lowest cost. Dependability, continuity of operation, low power, maintenance, and operating labor costs were the prime factors in their decision.

The Kennedy-Van Saun Air Swept Ball Mill Grinding System is the ultimate in Ball Mill Systems. The Kennedy Radial Flow classifier makes possible production of a wide range of product sizes, by positive external adjustments, to a high degree of accuracy.



Kennedy-Van Saun 11' Radial Flow Classifier and Cyclone collectors.

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- **Minimum Power**

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# CALCULATION OF RAW MIXES

## In the Manufacture of Portland Cement

By ZVONIMIR PUCAR*

THE AUTHOR treats the calculation of artificial raw mixtures in the production of portland cement in a new way, and illustrates the problem with practical examples.

It must be pointed out that this calculation is exact only if the raw material is of uniform composition, and the technological process is carried on in a rotary kiln using gaseous or liquid fuel, i.e., fuel with a minimal content of ashes. In case powdered coal is used as fuel, the hydraulic ratio will decrease, depending on the quantity and quality of ash present, in proportion with the increase of the silicate and other ratios.

In this case an exact treatment is particularly difficult as the decrease of hydraulic ratio mentioned above is not only a function of the composition of the ashes and the coal, but also of the heating power of the coal used; i.e., the necessary quantity of coal for the burning of clinker. But this again depends on the composition of the coal and on the burning process.

This calculation is also considered useful in processes where the heating is done by means of powdered coal, because the amount of change of each particular ratio during the process of burning in a particular installation and with the use of a particular coal is commonly known from experience. Besides the influence of ash on the composition of the resulting clinker can be easily and quickly controlled.

Advantages of this method as compared with those described in the literature are said to be many:

(1) Simplicity: The calculation may be done by an unskilled person using only a slide rule.

(2) Great speed of calculation: within two hours one can easily bring four components into harmony with regard to the hydraulic, silicate and aluminate ratios. Furthermore, one can obtain the yield and the composition of the burned clinker, and the percentages of $CaCO_3$ in the raw mixture or in the dried raw slurry. This last detail is necessary for the eventual additional correction of the crude raw mixture or slurry.

(3) Possibility of immediate control of the calculations: By using the slide rule, ratios will be obtained, if there was no miscalculation, which must correspond to the given ratios.

(4) This method can be used also for the calculation of other mixtures, provided they depend on certain proportions.

(5) It is not necessary to understand the given mathematical treatment of the problem, but only to apply the resulting equations in the manner illustrated in the examples.

*Engineer in cement industry, Zagreb, Jugoslavia

### Crude Mixture and Composition of Clinker

Through the analyses of good portland cements it has been established that the hydraulic qualities depend on the proportion of basic and acid components of the cement.

Therefore the chemist Michaelis introduced the conception of hydraulic ratio *(H)*, and he designed it as a proportion of calcium oxide to the sum of silicon dioxide, aluminum trioxide and iron trioxide. The cements having best hydraulic qualities are those whose hydraulic ratios are equal to 1.7-2.3. It is evident that the basic component here is CaO and acid components are $SiO_2$, $Al_2O_3$ and $Fe_2O_3$.

From this it can be deduced:

Hydraulic ratio

$$\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3} = 1.7\text{-}2.3$$

The following abbreviations are used:

Hydraulic ratio $= H$
Percent $SiO_2 = S$
Percent $Al_2O_3 = A$
Percent $Fe_2O_3 = F$
Percent $MgO = M$
Percent $CaO = C$
Percent $SO_3 = s$
Heating loss $= g$
Percent of moisture $= w$
or:
Percent of basic components $= b$
Percent of acid components $= k$

Therefore:

$$H = \frac{C}{S + A + F} = \frac{b}{k} = 1.7\text{-}2.3$$

It has been found that ordinary cement is not resistant against sea water; i.e. against the action of $MgSO_4$ or other soluble sulphates, because Candlot's salt or "cement bacillus" $CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 30H_2O$ will be formed.

It is possible, however, to manufacture a cement where Candlot's salt can not be formed at all, if the whole amount or at least the greatest part of $Al_2O_3$ is firmly bound to $Fe_2O_3$ forming tetracalciumaluminateferrite $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, so called Brownmillerit.

So a new proportion, the aluminate ratio *(A)*, a proportion of $Al_2O_3$ to $Fe_2O_3$, is introduced.

In the pure Brownmillerit this proportion is 0.64, or the aluminate ratio of Brownmillerit is 0.64. Of course the ordinary portland cement has an aluminate ratio greater than 0.64.

The aluminate ratio therefore is:

$$\text{Aluminate ratio} = \frac{Al_2O_3}{Fe_2O_3} \quad \text{or:} \quad A = \frac{A}{F}$$

The reciprocal value of aluminate ratio is the ferric ratio *(F)*:

$$F = \frac{F}{A}$$

Kühl suggested one more ratio, the silicate ratio *(S)*:

$$\text{Silicate ratio} = \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \quad \text{or:} \quad S = \frac{S}{A + F}$$

The silicate ratio influences the temperature of sintering in such a way, that the raw material with a high silicate ratio requires a higher temperature for sintering. Thus with the use of a suitable silicate ratio, the temperature of sintering can be regulated and the heating economy improved in the process of clinker burning. It is evident that the given ratios are important chemical characteristics of a raw material or a finished cement.

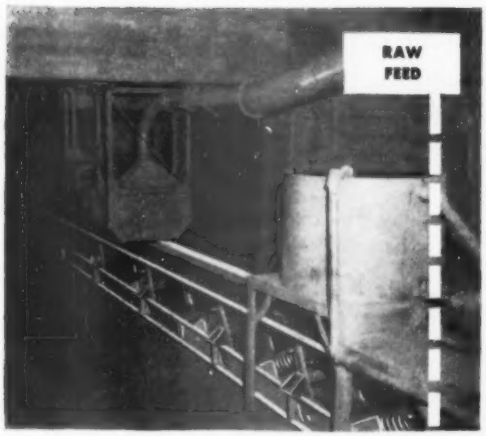
If portland cement is produced from the raw material in its natural state; i.e. marl, it is clear that the ratios cannot be chosen at will. The better the marl quality, the more its ratios are near to the optimal for the respective kind of cement.

By mixing two components, say limestone and clay, we can get a mixture with a given hydraulic ratio, while the other two ratios depend on the composition of the raw materials used. By mixing the two components, the raw material can be corrected only with regard to a certain ratio, and by mixing three components it can be corrected with regard to two ratios. Finally, by mixing four components the raw material can be corrected with regard to three ratios, and accordingly the properties of the burned clinker and cement can be regulated at will. In case we corrected the raw material with regard to all the three given ratios by mixing four components, its composition will still depend on the composition of each of the particular components used, while the rational composition of the clinker depends on the composition of the clinker, and on the manner of its burning and cooling.

In order to know in advance the composition of the clinker, it is necessary to calculate it from the proportions of each of the particular components and of their chemical composition.

We can thus in practice see at once, whether the mixture corresponds to the standard for portland cement, with regard to its chemical composition or not. The percentage of MgO

(Continued on page 128)

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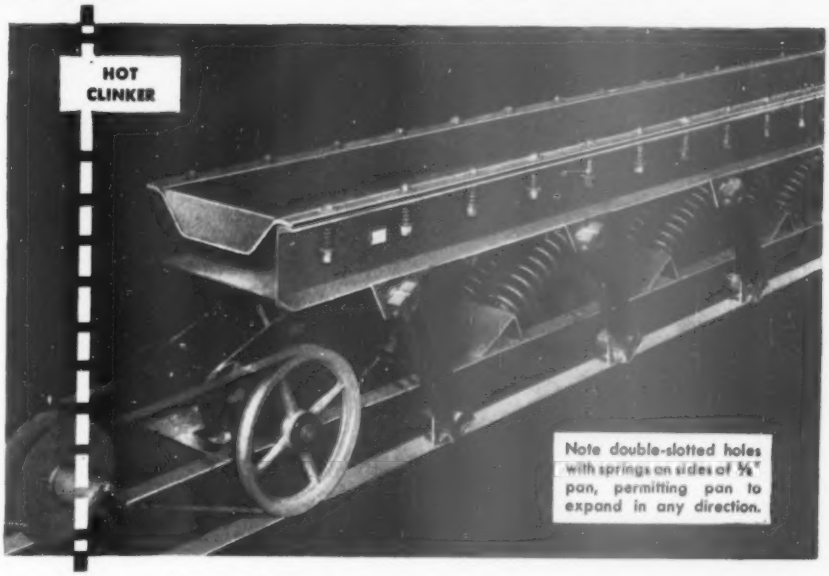


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## Raw Mix Calculation

*(Continued from page 126)*

and $SO_3$ in the burned clinker has to be taken into account, and probably also the amount of gypsum to be added before grinding the clinker.

The general deduction of the equations, by means of which it is possible to calculate the proportions of the two and four raw components and the percentage composition of the final product are given. Two practical examples of mixing two and four raw components respectively are added.

### Mixing of Two Raw Components to Get a Given Hydraulic Ratio

The abbreviations used are:

$H$ = Given hydraulic ratio of the mixture and clinker

$G_t$ = Quantity of the limestone in kilograms

$G_s$ = Quantity of the clay in kilograms

$b_t$ = Percentage of CaO in the limestone = $C_t$

$b_s$ = Percentage of CaO in the clay = $C_s$

$k_t$ = Percent $SiO_2$ + percent $Al_2O_3$ + percent $Fe_2O_3$ in the limestone = $S_t + A_t + F_t$

$k_s$ = Percent $SiO_2$ + percent $Al_2O_3$ + percent $Fe_2O_3$ in the clay = $S_s + A_s + F_s$

It follows:

$$H = \frac{Gb_t + Gb_s}{Gk_t + Gk_s} \quad (Gk_t + Gk_s)\,H = Gb_t + Gb_s$$

$$HGk_t - Gb_t = Gb_s - HGk_s; \quad G_t\,(Hk_t - b_t) = G_s\,(b_s - Hk_s)$$

$$\frac{G_t}{G_s} = \frac{b_s - Hk_s}{Hk_t - b_t} = \frac{b_s - Hk_s}{b_t - Hk_t} = n \quad \ldots\ldots (1)$$

$$\frac{G_t}{G_s} = G_s \cdot n \quad \ldots\ldots (2)$$

The proportion of mixing in percentages:

$$\frac{G_t}{G_t + G_s} = \frac{G_s \cdot n}{100}$$

The solution of these two equations are:

$$G_t = 100\left(1 - \frac{1}{n+1}\right) \text{ Percent} \quad \ldots\ldots (3)$$

$$G_s = \frac{100}{n+1} \text{ Percent} \quad \ldots\ldots (4)$$

**Example (1).** An artificial raw material with the hydraulic ratio $H = 2.02$ is to be obtained by mixing of limestone and clay. The composition of the limestone and clay is:

| | I. Limestone | II. Clay |
|---|---|---|
| $S$ | 2.5 percent | 55.7 percent |
| $A$ | 1.4 percent | 17.2 percent |
| $F$ | 1.1 percent | 8.3 percent |
| $M$ | 0.2 percent | 2.4 percent |
| $C$ | 53.0 percent | 1.4 percent |
| $s$ | 0.0 percent | 1.6 percent |
| $g$ | 40.0 percent | 3.0 percent |
| $w$ | 1.8 percent | 7.1 percent |
| alcal. | 0.0 percent | 3.3 percent |

Using the equation (1) we will calculate first the rate n.

$b_t = 53.0 \quad k_t = 5.0 \quad n = \frac{2.02 \cdot 81.2 - 1.4 = 162.6 = 3.79}{53.0 - 2.02 \cdot 5 \quad 42.9}$

$b_s = 1.4 \quad k_s = 81.2$

Using (3) and (4) we get percentages of the used raw components in the resulting mixture.

$$G_t = 100\left(1 - \frac{1}{4.79}\right) = 100 \cdot 0.791 = 79.1 \text{ percent}$$

$$G_s = \frac{100}{4.79} = 20.9 \text{ percent}$$

For every 100 kilogram of the raw mixture, we shall use 79.1 kilogram of limestone, and 20.9 kiogram of clay.

### Mixing of Four Raw Components to Get a Raw Mixture with the Given Hydraulic, Silicate and Aluminate Ratios

| I. | II. | III. | IV. |
|---|---|---|---|
| $S_1$ percent | $S_2$ percent | $S_3$ percent | $S_4$ percent |
| $A_1$ percent | $A_2$ percent | $A_3$ percent | $A_4$ percent |
| $F_1$ percent | $F_2$ percent | $F_3$ percent | $F_4$ percent |
| $M_1$ percent | $M_2$ percent | $M_3$ percent | $M_4$ percent |
| $C_1$ percent | $C_2$ percent | $C_3$ percent | $C_4$ percent |
| $g_1$ percent | $g_2$ percent | $g_3$ percent | $g_4$ percent |
| $s_1$ percent | $s_2$ percent | $s_3$ percent | $s_4$ percent |
| $w_1$ percent | $w_2$ percent | $w_3$ percent | $w_4$ percent |

The quantities of the raw components are $G_1$, $G_2$, $G_3$, and $G_4$.

The component I is a component with an excess of CaO; i.e., with a high $H$—for example, limestone.

The component II is a component with an excess of $SiO_2$; i.e., with a high $S$—for example, sand clay.

The component III is a component with an excess of $Al_2O_3$; i.e., with a high $A$—for example aluminous clay.

The component IV is a component with an excess of $Fe_2O_3$; i.e., with a high $F$—for example, iron ore.

The components II, III, and IV are brought out by means of the component I, (limestone) to the given hydraulic ratio:

Using (1) we have:

$$\text{Mixture I, II } \frac{G_1}{G_2} = \frac{C_1 - H\,(S_1 + A_1 + F_1)}{H\,(S_2 + A_2 + F_2) - C_2} = n_1 \quad \ldots\ldots (5)$$

$$\text{Mixture I, III } \frac{G_1}{G_3} = \frac{C_1 - H\,(S_1 + A_1 + F_1)}{H\,(S_3 + A_3 + F_3) - C_3} = n_2 \quad \ldots\ldots (6)$$

$$\text{Mixture I, IV } \frac{G_1}{G_4} = \frac{C_1 - H\,(S_1 + A_1 + F_1)}{H\,(S_4 + A_4 + F_4) - C_4} = n_3 \quad \ldots\ldots (7)$$

## Gypsum Production

DOMESTIC MINE PRODUCTION of crude gypsum during the second quarter of 1953 totaled 1,886,942 short tons, or 9 percent less than in the second quarter of 1952, and 18 percent below the record second-quarter output of 1951, as reported by the Bureau of Mines. Imports, however, showed a 12 percent increase. Production of calcined gypsum was 5 percent higher.

Second-quarter gains and losses among gypsum products were irregular. All of the industrial use classifications showed increases, with plate-glass and terra-cotta plasters having the largest gain of 41 percent. A 13 percent decrease was reported in base-coat plasters, while sanded plasters (including perlite premix) showed an 81 percent increase. Gauging and molding plasters and prepared-finish plasters were produced in lesser quantities, but miscellaneous building plasters were up 50 percent. Gains were also recorded in each of the prefabricated product classifications.

| | Short Tons | |
|---|---|---|
| | 1953 | 1952 |
| Crude gypsum: | | |
| Mined | 1,886,942 | 2,067,003 |
| Imported | 821,625 | 733,551 |
| Calcined gypsum produced | 1,798,289 | 1,719,595 |
| Gypsum products sold or used: | | |
| Uncalcined uses: | | |
| Portland cement retarder | 437,808 | 407,855 |
| Agricultural gypsum | 122,723 | 146,769 |
| Fillers and unclassified | 6,254 | 5,342 |
| Industrial uses: | | |
| Plate-glass and terra-cotta plasters | 15,849 | 11,233 |
| Pottery plasters | 10,929 | 10,560 |
| Dental and orthopedic plasters | 2,832 | 2,721 |
| Other industrial uses | 37,283 | 36,912 |
| Building uses: | | |
| Base-coat plaster | 432,369 | 494,822 |
| Sanded plaster | 68,290 | 37,713 |
| To mixing plants | 2,781 | 2,488 |
| Gauging and molding | 42,947 | 45,762 |
| Prepared finishes | 3,047 | 3,749 |
| Other building plasters | 79,923 | 53,347 |
| Keene's cement | 13,401 | 14,045 |
| Lath | 593,756* | 589,300* |
| Wallboard | 906,234* | 799,409* |
| Sheathing | 36,559* | 31,235* |
| Tile | 7,181* | 6,670* |

*M sq. ft.

## Kiln Coatings

NILS SUNDIUS of Stockholm has been making a study of the linings of a number of kilns after prolonged use in Sweden. With fire brick, a glassy crust is formed on the surface, in which some crystals of anorthite are found, as well as a few crystalites of gehelnite and a very few of dicalcium silicate. Analysis shows the crust to be intermediate in composition between cement and fire clay. This glass tends to penetrate into the joints and into the larger openings in the brick.

At the surface of alumina refractories, gehlenite crystals are most prominent, together with some brown millerite grains. On magnesia refractories, calcium silicate crusts are formed, free of tri-silicate, and some of these are also observed on alumina refractories. Both interfaces are characterized by numerous voids, which have resulted from recrystallization.

Where a clinker concrete had been used for lining, the part next to the kiln interior was a black regenerated clinker. Outside of that, and at temperatures below 1250 deg. C., a white concrete in which the tri-silicate had been decomposed to di-silicate and where the temperature was below 910, and free lime. Close to the kiln shell, much of the lime had become carbonated. (*Zement-Kalk-Gips*, Vol. 6, No. 1, p. 1, 1953.)

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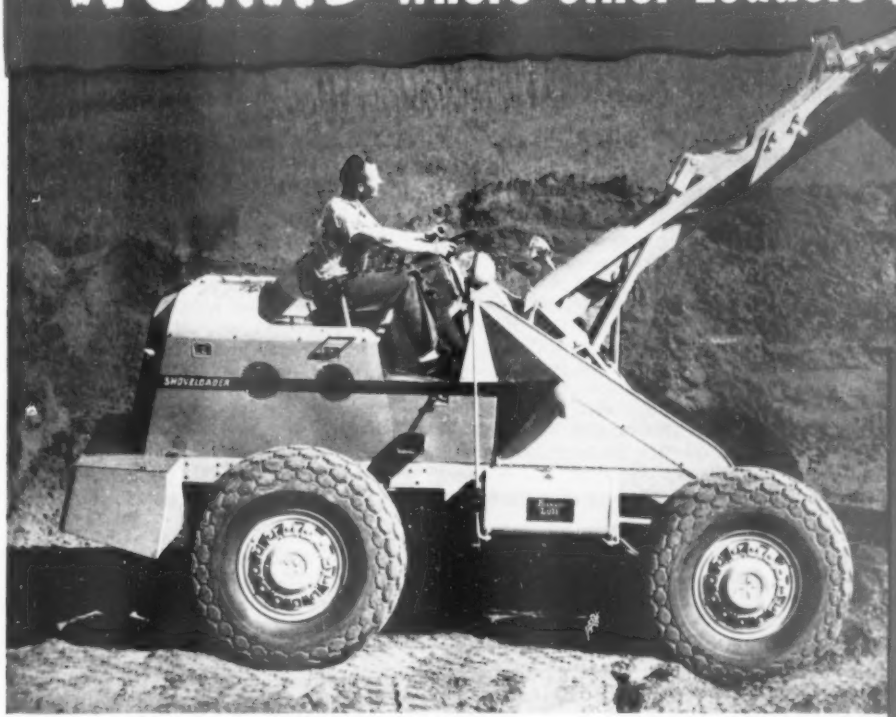

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# POZZOLANIC CEMENTS
## From Blast Furnace Slag

By R. C. LIED[1], J. H. HANDWERK[2], T. N. McVAY[3]

"THE TERM POZZOLAN, possibly unfamiliar, requires explanation. It is used to describe any material which, while not necessarily cementitious by itself, will when mixed with lime combine chemically with it to form a hydraulic cement; that is, one which will set out of contact with air, in contrast with plain fat lime mortars which will only set in the presence of air containing carbon dioxide."[4] Among such materials are natural pozzolanic rocks such as volcanic ash as well as dehydrated clay and quenched blast furnace slag. The investigators were particularly interested in the pozzolanic properties of quenched blast furnace slag as this is used by one company operating in the Birmingham district of Alabama. The primary purpose of this investigation was to determine whether differences in crystal-to-glass ratio in blast furnace slags had an effect on the pozzolanic activity of cements. Time of set and tensile strength tests were used to evaluate the pozzolanic activity.

### Analyses of Slags

The analyses of the slags used in this work are given in Table 1.

TABLE I. ANALYSES OF SLAGS

| | Commercial slag* | Synthetic slag, calculated | Synthetic slag* after melting |
|---|---|---|---|
| $SiO_2$ | 37.90 | 33.41 | 41.36 |
| $Al_2O_3$ | 11.63 | 10.79 | 15.83 |
| $Fe_2O_3$ | 0.86 | 1.25 | 1.52 |
| $TiO_2$ | 0.40 | ..... | 0.31 |
| $MnO_2$ | 0.20 | 0.27 | 0.19 |
| CaO | 44.04 | 52.64 | 37.56 |
| MgO | 1.94 | 1.64 | 1.88 |
| $Na_2O$•$K_2O$ | 1.17 | ..... | 0.81 |
| $P_2O_5$ | 0.05 | ..... | 0.05 |
| $SO_3$ | 1.80 | ..... | 0.53 |
| BaO | 0.03 | ..... | ..... |
| | 100.02 | 100.0 | 100.04 |

*Analyses by Emerson P. Poste, Chattanooga, Tenn.

A sample of the commercial blast furnace slag was taken when it was received, and analyzed. A synthetic slag was made by combining silica, aluminum hydrate, calcium and magnesium carbonates, ferric oxide and manganese dioxide in the proportions which on the ignited basis should give the composition shown in column 2 of Table 1. The analysis of the slag (column 3), melted in fire clay crucibles, shows that the crucibles were partly taken into solution, due to the corrosive nature of the slag. Consequently, the melted slag was higher in silica and alumina and lower in calcia than the mixture of the raw materials.

## PROCEDURE

### Processing of slags

The synthetic slag was melted in fire clay crucibles, quenched in water and stored until enough was prepared to carry out all of the tests. Fireclay crucibles containing both the commercial and the synthetic slags, were placed in electrically fired kilns and melted at 2500 deg. F. The crucibles were cooled at varying rates to obtain slags with a number of different crystal-to-glass ratios. All slags were crushed to pass 150 mesh and were used as such in the various pozzolana-cement compositions.

### Microscopic Examinations

The identification of the crystalline phases was made by the use of the petrographic microscope and confirmed with X-ray diffraction patterns.

Portions of the reheated slags were crushed to pass 100 and screened on 200 mesh. The grains were mounted on microscope slides using an oil with a known refractive index as a mounting medium. The slide was placed on a Wentworth screw micrometer stage and intercepts of the crystals and glass were measured by taking straight-line traverses across the slides. The method is tedious and a large number of traverses were necessary to obtain a relatively constant crystal-to-glass for each reheated slag. At best, this method must be considered to be approximate only, however, it was possible to obtain slags with well defined crystal-to-glass ratios.

### Tensile Strength Tests

A standard 1:1:3 mixture was used[5] for tensile strength briquettes; i.e., one part of portland cement, one part of commercial hydrated lime and three parts of standard (20-30) mesh sand by weight, except that 20 percent by weight of the portland cement was replaced with the pozzolanic slags.

The batches were mixed for 30 min. in porcelain jars using a few flint pebbles to aid thorough mixing and 17 percent water was added to the dry powder and thoroughly mixed. A.S.T.M. specifications C-190-44 were followed in making and storing the tensile strength specimens. Test specimens were stored in a humidity cabinet and these were tested at the end of the 7, 14, and 28 days. Also, some of the specimens were aged under water for 28 days. A Tinius Olsen tensile strength testing machine was used for making the tensile strength tests.

### Time of Set Tests

These tests were conducted on mixtures of four parts of the pozzolanic slags with one part of hydrated lime. After thorough mixing, 24 percent of water was added and the time of set determined with Gilmore needles, according to A.S.T.M. specifications C-191-44.

## RESULTS

### Petrographic Examinations

The petrographic examinations of both slags showed the major constituents to be anorthite ($CAS_2$), pseudowollastonite (CS), and a minor amount of gehlenite ($C_2AS$) and the identifications were confirmed with X-ray diffraction patterns. If the $Al_2O_3$, (CaO•MgO), $SiO_2$ contents of the slags are recalculated to a 100 percent basis and this composition placed on the $CaO$-$Al_2O_3$-$SiO_2$ diagram, it will be noted that the commercial slag falls in the $Cs$-$C_2AS$-$C_3S_2$ triangle, whereas the melted synthetic slag is in the CS-$CAS_2$-$C_2AS$ triangle. The latter agrees with the results of the mineral examinations, however, with the commercial slag the impurities may markedly affect the phases present.

The crystal-to-glass ratio of the reheated slags are shown in Table 2 on page 136.

The results show that the strength increased with time of storage in the humidity cabinet. There are no significant differences between the samples stored under water for 28 days and those stored in the humidity cabinet for the same period of time. There are minor discrepancies in the

(Continued on page 136)

[1] Submitted as a thesis fulfilling part of the requirements for the degree of Master of Science in Ceramic Technology, University of Alabama.

[2] Assistant Professor of Ceramic Technology, University of Alabama.

[3] Professor of Ceramic Technology, University of Alabama.

[4] Anon. "Discussion on Pozzolanas" ROCK PRODUCTS 33 (20) 55, (1930).

[5] Communication from R. B. Coleman, Southern Cement Co., Birmingham, Alabama.

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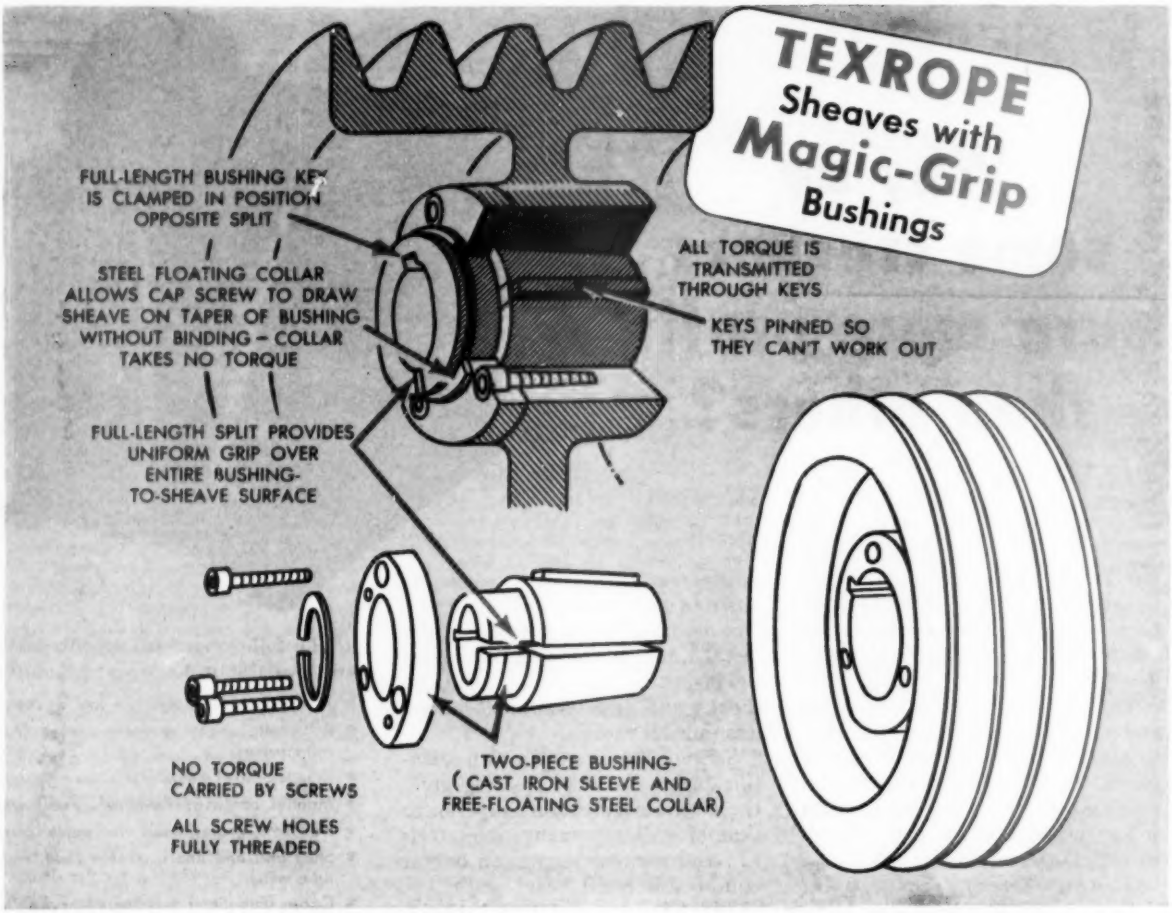
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# INFORMATION

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## TO HELP YOU MEET TODAY'S PROBLEMS AND TO MAKE PLANS FOR TOMORROW

1 AIR COMPRESSORS—Davey Compressor Co. has announced Form E describing the Super Chief 315, 500, and 600 c.f.m. compressors. Illustrations show each model in four-wheel and skid trailer mounted units. Complete specifications are listed along with an air requirement table for air tools.

2 BATCH MIXERS AND SKIP LOADERS—The Gene Olsen Corp. has released a pamphlet showing its combined line of various sizes of GO Corp. batch mixers and skip loaders. Specifications, drawings and photographs are given.

3 BUILDING CONSTRUCTION CODES—Midwest Conference of Building Officials and Inspectors has released a comprehensive 68-page directory of the public officials of the Midwest States who administer and enforce codes and regulations governing building construction. Also listed are the type of codes under which the governmental agency regulates building, plumbing, electrical, heating and related subjects. The directory is available at a cost of $10 per copy from the Conference at 207 Holliday Bldg., Indianapolis, Ind.

4 CALCIUM CHLORIDE FOR ICE CONTROL—Calcium Chloride Institute has published Manual IM-1, describing the use of calcium chloride for ice control, with accompanying reference data. Photographs and density, freezing point and concentration tables are also given.

5 CASTINGS—Stoody Co. has issued the second edition of a booklet entitled "Stoody Castings." Various type hard metal alloy castings are described and illustrated.

6 CELLULAR CONCRETE — Calsi-Crete Corp. has published a booklet entitled, "The Ideal Building Material!—Calsi-Crete," giving descriptions of the nature and development of cellular concrete and the interest and activity in this material. Types of products, methods of manufacture and economics of production are discussed and compared. The outstanding advantage of autoclaved "Calsi-crete" products are also indicated.

7 CONVEYING SYSTEMS—Fuller Co. has released Bulletin FK-26, describing and illustrating Fuller-Kinyon conveying systems. Typical application photographs, construction and operation data, and line drawings, showing installation layouts, are included.

8 CRANE CAB CONDITIONERS—Dravo Corp. has released a 23-page bulletin describing and illustrating its crane cab coolers and conditioners. Included are specifications and line drawings.

9 CRANE-SHOVELS—The Thew Shovel Co. has published an eight-page booklet on the construction of the Lorain-TL series of shovels and cranes. The booklet consists of rotogravure printing on transparent acetate film so that the various assemblies in the machine can be superimposed on each other by turning the pages. Each page shows one "packaged" component of the turntable in detail.

10 DIESEL ENGINES—Caterpillar Tractor Co. has announced Form 30757 giving a list of applications for diesel engines. Research, engineering and manufacturing data are given, and 28 different applications are shown.

11 DRAIN PIPES—Walker Cement Products Co., Poroswall Pipe Div., has published a brochure on "Poroswall" drain pipes, listing its advantages, specifications, standard dimensions and strength requirements. Photographs and a cross-sectional drawings are also included.

12 DREDGING — Yuba Manufacturing Co. has published a 40-page booklet on its placer mining dredges. Typical job applications, such as gold, and sand and gravel dredging, are illustrated and described.

13 DUST COLLECTOR—American Air Filter Co., Inc. has announced Bulletin 277 describing its Design 4, Type N Roto-Clone dust collector.

14 EARTHMOVING EQUIPMENT—Caterpillar Tractor Co. has announced Form 30752 showing the DW20 tractors with W20 wagons, and DW10 tractors with W10 wagons at work with other equipment moving earth, ore, and bulk materials.

15 ELECTRIC HOISTS—The Yale & Towne Mfg. Co., Yale Materials Handling Div., has published an eight-page booklet describing and illustrating Load King electric hoists with lifting capacities ranging from ¼ to 1½ tons.

16 ELECTRONIC CONTROLLERS—The Bristol Co. has available Bulletin B226 describing its line of free-vane electronic controllers. Complete specifications are included.

17 ELECTRONIC TEMPERATURE CONTROLLER—Minneapolis-Honeywell Regulator Co., Industrial Div., has released Bulletin P-811 giving application information and specifications for the 077 electronic temperature controller in both the single-point and cascade models. Included in the bulletin are data on resistance thermometer elements and wells, and Modutrol motors, and industrial control motors suitable for use with the 077.

18 ELEVATOR BUCKETS—Link-Belt Co. has released a 12-page booklet, No. 2465, on its line of cast malleable and Promal elevator buckets for handling coal, cement, chemicals, pulp, clay, etc. Fifty-five standard sizes are listed, and tables are included which give dimensions, weights and capacities. Various chain attachments and elevator bolts are illustrated.

19 FLOTATION EQUIPMENT—Denver Equipment Co. has published a series of flowsheets in Bulletin FLO-B80, describing the flexibility of "Sub-A" flotation machines.

20 FORK TRUCK — Elwell-Parker Electric Co. has issued a folder describing and illustrating Type F-31T, a 6000-lb., electric-powered fork truck. Typical application photos are given and engineering drawings give detailed specifications.

21 GEARMOTORS — Westinghouse Electric Corp. has issued Booklet B-5645 describing complete line of Life-Line gearmotors. Features of the gear unit and motor are discussed. Gear ratios for single, double and triple reduction types are given, and other gearmotor designs developed for a particular requirement are also described.

22 GRAVEL PLANTS—Pioneer Engineering Works, Inc. has published a series of bulletins describing and listing specifications on its line of bottom-deck-feed plants for gravel aggregate production. The line consists of models 17-V, 18-V, 24-V, 25-V, 39-V, 40-V and 46-VE duplex gravel plants.

23 HARD-FACING—Stoody Co. announced publication of a Spanish translation of the "Stoody Guidebook," describing and illustrating over 100 uses of hard-facing alloys in maintenance of heavy equipment used in mining, earthmoving, cement plants, rock products and clay plants.

24 HOIST LINE—Union Wire Rope Corp. has announced a brochure describing the Tuffy hoist line, a hoist and sling combination, for overhead, stiff leg and mobile cranes, clamshells and derricks.

25 HYDRAULIC CONTROLS — Caterpillar Tractor Co. has published Form 30794 describing and illustrating three types of hydraulic controls, both front and rear mounted, available for the operation of scrapers, shovels, loaders, tool bar arrangements, etc. Cutaway and job photographs are included.

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# Information on NEW LITERATURE about your business

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26 INDUSTRIAL EXPLOSIVES—Atlas Powder Co., Explosives Dept., has published a 48-page catalog entitled "Atlas Explosives Products," which gives specific aid in the selection of industrial explosives for underground and strip mining, quarrying and construction, pipelining, etc. Typical application illustrations and a section on millisecond delay blasting are included as well as a complete index of more than 150 items.

27 KILN LININGS—Kaiser Aluminum & Chemical Sales, Inc., Chemical Div., has published "Basic Hot-Zones for Cement Kilns," an instructional booklet on the installation of refractory brick in cement kilns. Illustrations and drawings are used throughout.

28 KYANITE FLOTATION—Denver Equipment Co. has brought out Bulletin M4-B68 describing the recovery of kyanite by flotation at Commercialores, Inc. Every aspect of production is told beginning with the geology of the kyanite formation and its removal from the quarry, to the mill operations.

29 LIQUID CYCLONE—The Dorr Co. has released Bulletin 2502 describing the two types of multiple-unit type TM DorrClones, giving advantages, applications and operating data. Illustrations are used throughout.

30 LOADERS—The Jaeger Machine Co. has released Catalog L100-3 describing and illustrating its "Load-Plus" loaders. Parts and typical application illustrations are given as well as specifications and dimensions.

31 LUBRICATION SYSTEMS—Trabon Engineering Corp. has brought out Bulletin 529 describing its centralized lubrication systems, both manifold and reversible. Pumping units for oil and grease are also described and illustrated.

32 MOTOR CONTROL — General Electric Co. has released Bulletin GEA-5409 describing Limitamp high-voltage motor control, its operation and application. Photographs, charts and dingrams are given, and typical dimensions of the full-voltage and reduced-voltage control panels are included.

33 MOTORS, PUMPS—The Oilgear Co. has announced Bulletin 10051-C illustrating and describing a complete line of Fluid Power pumps, motors, transmissions, cylinders and valves. Specifications and pressure ratings are given.

34 OHIO MINERAL RESOURCES — The Ohio Division of Geological Survey, Dept. of Natural Resources, announced the publication of a 47-page, illustrated information circular, No. 9. It gives the story of Ohio's mineral resources, and includes maps and photographs of the industries developing the various resources. The clay and shale, limestone and dolomite, sand and gravel, lime, gypsum, and sandstone industries are among those covered. A section gives reference information covering all the reports and maps ever published by the Survey.

35 PNEUMATIC CONVEYING SYSTEMS —Convair Inc. has available Bulletin No. 104 describing and illustrating pneumatic conveying systems. Typical installation drawings are given.

36 PERFORATED METALS — Diamond Manufacturing Co. has announced Catalog 39 illustrating and describing various type perforated metals for elevator buckets, sizing screens, dust collecting, etc. Included are specification tables and illustrations showing the perforation sizes.

37 PORTABLE AIR COMPRESSORS—Worthington Corp., Construction Equipment Div., has announced Bulletin H-850 which describes and illustrates the design features of "Blue Brute" portable air compressors. Typical application photographs are given, and specification and dimension tables are also included.

38 PROCESS CONTROL EQUIPMENT—Barber-Colman Co., Wheelco Instruments Div., has issued Bulletin TC-10, on its line of thermocouples, radiation detectors, and resistance bulbs. Information is also given on protection tubes, lead wire and other accessories for use with indicating, controlling, and recording instruments.

39 PYROMETER CALIBRATION — The Bristol Co. has published Bulletin P1259 entitled, "Pyrometer Thermocouple Calibration Data," containing tables based on data recently released by the National Bureau of Standards.

40 SCREW WASHERS — McLanahan and Stone Corp. has prepared Bulletin Sw-953 describing and illustrating screw washers in single and double screw models. Specifications and construction, lubrication and operation data are included.

41 SPACE HEATER—Dravo Corp., Heating Dept., Machinery Div., has released Bulletin 30-C-43 describing and illustrating its Paraflo space heater. Engineering data and line drawings are included.

42 STORAGE BATTERIES—Gould-National Batteries, Inc. has released a 60-page booklet giving instructions and technical data for its rubber jar batteries. Tables and illustrations of battery tools and auxiliary equipment are given. A brief treatise on the theory of the lead-acid battery is also included.

43 TESTING INSTRUMENTS—General Electric Co. has available a 16-page bulletin, GEA-5469B, giving data on testing instruments such as hook-on volt-ammeters, watt-meters, power-factor meters, portable recorders, voltmeters and ammeters, phase-sequence indicators, etc. Application data, features of each instrument and typical application photographs are included.

44 TESTING INSTRUMENTS—J. W. Dice Co. has released Bulletin 32 describing and illustrating non-destructive testing instruments applicable to cement, crushed stone, etc.

45 THAWING PITS—Hauck Manufacturing Co. has published Bulletin 1041 describing and illustrating its prefabricated thawing pits for thawing frozen railroad hopper cars of coal, limestone, etc., with radiant heat. Specifications are also included.

46 TRANSMISSION BELTING — Goodyear Tire & Rubber Co. has released Brochure A5163K illustrating and describing Thor rayon transmission belting. Its features and uses are included.

47 UNIVERSAL JOINTS — Gear Grinding Machine Co., Joint Div., has published a 12-page illustrated catalog on Rzeppa universal joints. Applications, engineering data, models and sizes, and proper joint selection are given. The constant velocity principle on which the joints are designed is described and illustrated.

48 WELDING—The Lincoln Electric Co. has announced a booklet entitled, "The Case of the Ailing Weldollar." It presents an analysis of the basic causes of high costs and suggests a plan for reducing them.

49 WIRE ROPE—Bergen Wire Rope Co. has prepared a data sheet listing the various service conditions affecting wire rope.

50 WIRE ROPE SLINGS—Leschen Wire Rope Div., H. K. Porter Co., Inc., has released a folder entitled, "New Ideas in Red-Strand Slings," describing the Red-Strand line of multiple part slings and Pin-Lock thimbles. Also described are single-part slings equipped with single-swaged fittings, as well as grommet slings.

51 WIRE ROPE—H. K. Porter Co., Inc., Leschen Wire Rope Div., has issued a brochure entitled, "What's the Difference in Wire Rope," explaining differences in the selection of wire for various type wire rope, and the differences in manufacturing processes.

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| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
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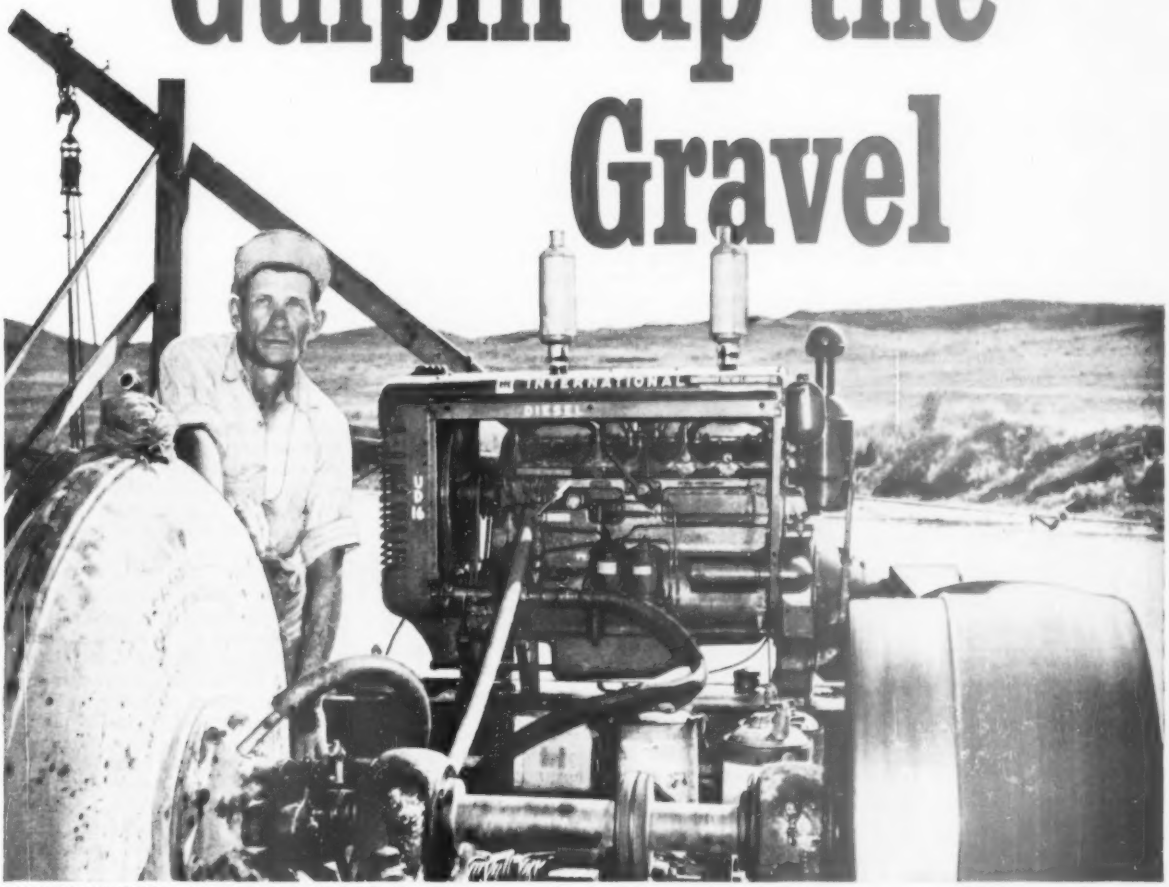


PAYTON'S PLEASED with how economical UD-16 s are to run. *"In producing 350 cubic yards of gravel in a ten hour day, our UD-16 uses only 25 gallons of diesel fuel, and not enough oil to mention,"* says veteran operator John Payton.

HALFWAY 'CROSS THE CALAMUS. On a typical job like this, International's UD-16 engine powers the pump sucking a cubic yard of gravel every 1¾ minutes from a 25-foot depth, pushing it 100 feet to the bank, with a 30-foot lift to the screen.

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## Pozzolanic Cements

*(Continued from page 130)*

7 day tests with increased glass content, however, with all other tests there was an increase of tensile strength with an increase of glass content.

TABLE 2. CRYSTAL-TO-GLASS RATIO FOR THE REHEATED SLAGS

| Synthetic Slag | | Commercial Slag | |
|---|---|---|---|
| No. | Percent glass | No. | Percent glass |
| 1 | 0.0 | A | 0.0 |
| 2 | 19.0 | B | 19.0 |
| 3 | 28.0 | C | 39.0 |
| 4 | 41.0 | D | 61.0 |
| 5 | 50.0 | E | 81.0 |
| 6 | 62.0 | F | 100.0 |
| 7 | 80.0 | | |
| 8 | 100.0 | | |

### Tensile Strength Tests

The results of the tensile strength tests are shown in Table 3.

TABLE 3. TENSILE STRENGTH TESTS OF POZZOLAN CEMENTS

**Synthetic Slag**
**Tensile Strength P.S.I.**

| Pozzolan | Stored in Humidity Cabinet | | | Under Water |
|---|---|---|---|---|
| | 7-day[1] | 14-Days | 28-Days | 28-Days |
| 1 | 233 | 243 | 256 | 250 |
| 2 | 228 | 261 | 271 | 263 |
| 3 | 226 | 272 | 274 | 276 |
| 4 | 230 | 272 | 286 | 278 |
| 5 | 220 | 262 | 289 | 275 |
| 6 | 254 | 271 | 292 | 286 |
| 7 | 264 | 282 | 300 | 319 |
| 8 | 263 | 289 | 306 | 333 |

**Commercial Slag**
**Tensile Strength P.S.I.**

| Pozzolan | Stored in Humidity Cabinet | | | Under Water |
|---|---|---|---|---|
| | 7-day[1] | 14-Days | 28-Days | 28-Days |
| A | 209 | 212 | 238 | 219 |
| B | 205 | 225 | 246 | 225 |
| C | 200 | 226 | 257 | 247 |
| D | 217 | 252 | 278 | 256 |
| E | 232 | 282 | 302 | 288 |
| F | 273 | 311 | 336 | 329 |

[1]Average of results on breaking six test specimens. Eight specimens were broken in all other tests, except for pozzolans 2, 3, 4, 5 and 8 where seven specimens were used.

### Time of Set Tests

The results of these are shown in Table 4.

TABLE 4. TIME-OF-SET TESTS, IN HOURS

| Synthetic Slag | | | Commercial Slag | | |
|---|---|---|---|---|---|
| Pozzolan No. | Initial Set | Final Set | Pozzolan No. | Initial Set | Final Set |
| 1 | 30 | 48 | A | 26 | 46 |
| 2 | 30 | 48 | B | 24 | 40 |
| 3 | 24 | 42 | C | 22 | 36 |
| 4 | 22 | 36 | D | 18 | 28 |
| 5 | 22 | 34 | E | 14 | 22 |
| 6 | 18 | 30 | F | 14 | 20 |
| 7 | 18 | 30 | | | |
| 8 | 18 | 26 | | | |

It should be noted that the time of initial set decreased with increasing glass content of the pozzolanic composition, but this is not as well marked as with the time of final set. In general, time of set tests are used to differentiate between active and inactive materials. A pozzolan is considered active if the initial set occurs under 50 hours and the final set under 100.

### Acknowledgment

The writers wish to express their appreciation to R. B. Coleman, Southern Cement Co., Birmingham, Ala., for his assistance in this investigation.

The greater the amount of glass either in the commercial blast furnace slag or the synthetic slag, the greater is the tensile strength of the cement. The thoroughly and rapidly quenched slags have the greatest pozzolanic activity.

The slags containing the most glass had the fastest time of set, also, showing that the glass content markedly affects the pozzolanic activity.

If the pozzolan is considered active if the initial set occurs under 50, and the final set under 100 hours, then completely crystallized slags show some pozzolanic ativity.

The method of measuring crystal-to-glass ratios by the use of a Wentworth screw micrometer stage is satisfactory, providing the crystals are large enough to be differentiated from the glass.

## Foreign Cement Production

ALGERIA: Total cement production in 1952 amounted to 469,805 metric tons.

BRITISH EAST AFRICA: (Uganda): The cement plant at Tororo began operation early in 1953. Plant capacity is approximately 55,000 tons annually.

CEYLON: The country's government-owned cement plant was placed in production in 1950 with a rated annual capacity of 100,000 long tons of cement of the British Standard Specification. Before World War II, consumption of cement in Ceylon had reached 70,000 tons per year, but by 1953, domestic consumption had reached 200,000 tons per year. The government is now planning an expansion program to increase the plant's output to meet all Ceylon's requirements. In the meantime, the domestic supply of cement is being augmented by imports from several countries, with the United Kingdom as the principal supplier, supplying 69 percent of the total 1952 imports. India supplied 13 percent; Japan, 9 percent; with the remainder from Germany, France, Belgium, Sweden, Italy and Denmark.

DOMINICAN REPUBLIC: Cement production totaled 137,257 metric tons in 1952, compared with 103,523 tons in 1951.

GREECE: Production of cement in 1952 totaled 595,540 metric tons, with 102,804 tons being exported, principally to Turkey and Syria. Cement imports totaled 1660 tons, principally from Denmark.

MALAYA: Imports of cement totaled 418,296 long tons in 1952, chiefly from the United Kingdom (231,284 tons), and Japan (154,901 tons). Other imports were from Denmark, Formosa, French Indochina, Germany, Belgium, Hong Kong, Sweden, Czechoslovakia and Union of South Africa. The 1952 exports totaled 19,393 long tons, principally to Sarawak, Thailand, Sumatra, Brunei, Riouw, North Borneo, and the remainder to other Asiatic countries.

NETHERLANDS: Portland cement imports in 1952 totaled 730,582 metric tons, of which 445,806 tons were from Belgium-Luxembourg, 283,789 tons from West Germany, and 987 tons from Denmark. White cement imports totaled 6230 tons, while imports of cement clinker totaled 123,129 tons. The 1952 export of portland cement amounted to 7736 tons, principally to Surinam, Indonesia, Netherlands Antilles and Dutch Guiana.

NICARAGUA: Approximately 456,400 bags of cement were produced in 1952, a slight decrease from the 475,900 bags produced the preceding year. With an increased demand for cement, due to an increased private dwelling and business construction program, the country was compelled to rely upon imports from Panama to meet its requirements.

PHILIPPINE REPUBLIC: Production of cement totaled 1,855,772 bbl. in 1952, compared with 1,850,927 bbl. in 1951. Cement is listed first among principal non-metallic minerals produced in the country. Currently there are three cement plants in operation. The proposed San Fernando plant of Cebu Portland Cement Co. is expected to be in production in 1954.

SWEDEN: Consumption of cement increased in 1952 by 2.5 percent, or to 249 kilos per inhabitant per annum, which was the largest annual per capita consumption ever attained in Sweden. Production was greater than consumption, and out of the surplus, 306,500 metric tons (4.6 percent more than in 1951) were exported to 23 countries.

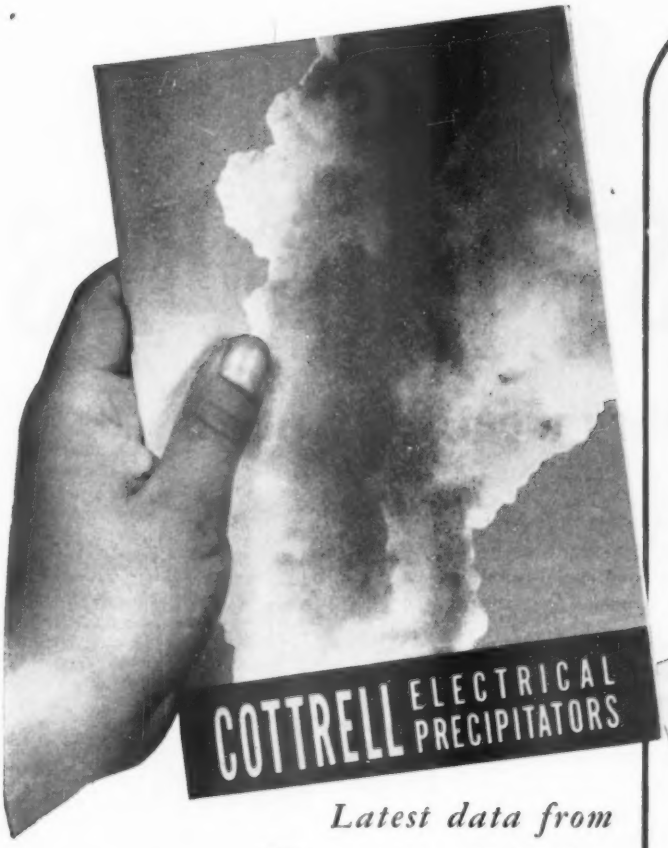
THAILAND: Cement production in 1952 totaled 247,401 metric tons, compared with 228,676 tons in 1951, and 165,329 tons in 1950.

YUGOSLAVIA: Total cement production in 1952 amounted to 1,313,000 metric tons. For the first quarter of 1953, cement production reportedly was running about 30 percent above that of the first quarter of 1952.

These reports were taken from the April, May, June, July and August, 1953, issues of *Mineral Trade Notes*, published by the Bureau of Mines, Washington, D. C.

## Acquires Quarry

DILLON STONE CO. recently purchased Louisa County's lease to the Mabeus stone quarry at Columbus Junction, Iowa. The county leased the quarry from Ralph and Howard Mabeus in 1951, paying them a royalty of 6¼¢ per cu. yd. The recent purchase price of $9000 included the quarry lease and equipment.

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## Labor Relations Trends

*(Continued from page 77)*

fore, that he was untrained for the work he was assigned to do.

"Exhibits and other evidence produced at the hearing established the fact that a distance of some 300 ft. separated the feed chute, damper control lever, and fan switch from the control panel. At the time of the incident in question, no gauge or chart of any kind on the control panel would indicate whether a water hose was in the feed chute, or whether the water was turned on there. A man had to go from the control panel to the feed chute—300 ft.—and return, to determine this; normally, a drop in temperature would indicate water was coming into the kiln, provided air and fuel remained constant or were decreased.

"One exhibit is a 'daily kiln record,' showing, among other things, the amount of draft on a given kiln at two-hour periods. It shows a draft differential reading at 3 p.m. on July 1, 1953, of 1.8 and a draft differential reading at 5 p.m. on that day of 0.7. An 11 p.m. reading shows 0.1 draft differential zero (0) indicating a completely closed damper. The accused employe made the 3 p.m. and the 5 p.m. entries on this record and, therefore, knew at 5 p.m. that the damper was still 0.7 open.

### Contentions of Parties

"It is the contention of the union that the damage to the chain section was unavoidable, without any intent on the kiln-burner's part, and that any other kiln-burner would under the same or similar circumstances have done the same things he did on this occasion. The union feels he was unjustly discharged because of events beyond his control, and asks that he be reinstated without loss of pay or seniority.

"It is the contention of the company that the operation of the kiln was his responsibility, that he was grossly negligent, and that therefore his discharge—made after the plant manager weighed all the facts—was justified. The company contends he did not do the ultimate insofar as shutting the air draft was concerned, or in shutting down all controls to the kiln when the emergency became apparent.

"As best shown by all the evidence, the chains would not have melted and the kiln temperature would have dropped gradually from 3:15 p.m. if (1) water replaced the kiln feed, (2) the gas fuel was cut back, and (3) the draft was eliminated by closing the damper control lever or by cutting off the fan switch.

"As to the first, the kiln-burner testified that he sent his helper to insert the water hose and that he himself personally checked this hose three times, and only found it outside the feed chute on the fourth check. It is usual and customary for kiln-burners

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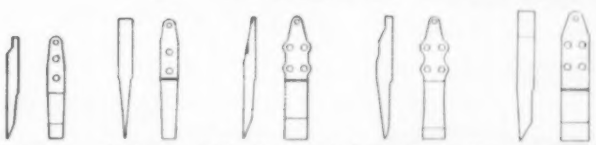

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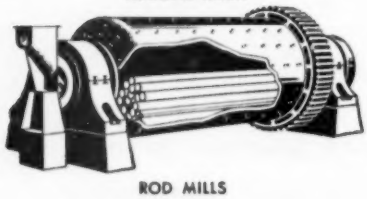

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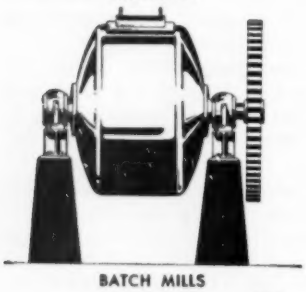

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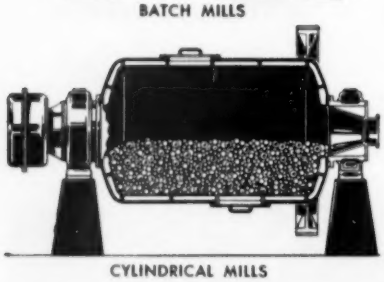

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to send helpers to do this phase of the work, and we can therefore place no blame on the kiln-burner if, for unknown reasons beyond his power or control, the hose became disengaged and water turned off. The temperature drop after 3:15 p.m. could have been caused by the decrease in fuel, had the hose never been inserted into the feed chute, or the intake of water into the kiln could have similarly caused the temperature drop. He did the ultimate insofar as the hose and water factors were concerned.

"As to the second and third, however in the face of an existing and mounting emergency when the kiln temperature neared 700 deg.—with rapid increases—the kiln-burner acted imprudently and improperly. Particularly was he grossly negligent in allowing the air draft damper control to remain 0.7 open, and the fan still in full operation. By his statement and by exhibit which he kept, he closed the damper as far as he could and knew it was not fully closed because he made the 0.7 entry on the daily kiln record at 5 p.m. When he partially closed the damper, he still had sufficient time to summon aid in order to fully close it, or could have simply thrown the fan switch which would have killed the draft entirely. He did neither, and no evidence was introduced to show that he sought assistance to effect a complete closing of the damper control lever.

"The closing down on the kiln was the kiln-burner's responsibility. When the operation became an emergency, he should have known the proper procedure to follow in order to reduce the temperature at the rear end of the kiln. He knew the damper was open, and knew the fan switch would decrease the supply of oxygen in the kiln. If he was unable physically to close the damper, he could have sought assistance; if unable to summon aid for this, he could have—unassisted—thrown the fan switch. The open air draft was certainly a major contributing factor in the ultimate damaging of the chain sections and segments, and he had knowledge of this factor for he entered it on his daily kiln record. Yet he did nothing to correct this condition.

(Here follow precedents to justify the arbitrators' decision.)

"In various reported cases there were reductions of discharges to temporary layoffs in instances where the employes had excellent work records, or were on new and unfamiliar jobs, but these holdings are inapplicable here. In paragraph 5 of the agreement, a 30-day probationary period is provided for employes placed on new jobs, after which time they are considered competent; as stated earlier in this discussion, this employe had been a kiln-burner for about 18 months prior to July 1, 1953, the date of the incident in question.

"The employe was careless and negligent in the above particulars and the company was justified in discharg-

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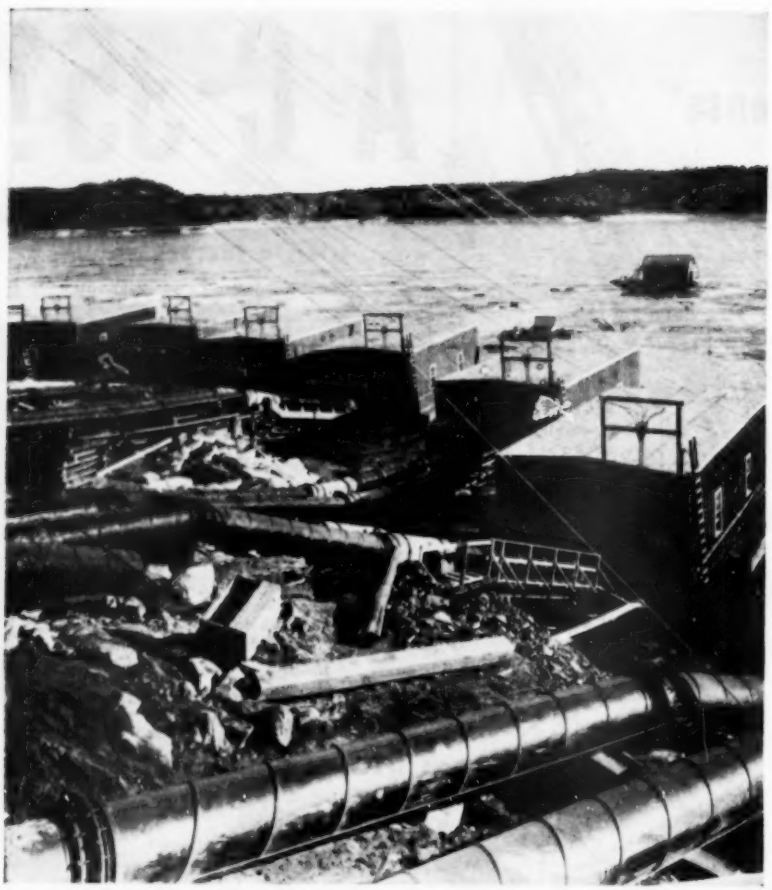

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ing him under the provisions of Article XIV, paragraph 1, of the agreement which provides for discharge of an employe for 'good and sufficient cause.'

### Award

"On the basis of all the evidence and argument of the parties, and after careful consideration thereof, and for the reasons set forth above, it is our decision and we award that the union's grievance is hereby rejected."

* * *

### County Road Work Not Interstate Commerce

The National Labor Relations Board decided October 13, 1953 that the Johnson Concrete Co., Salisbury, N. C., need not contract with the United Stone and Allied Products Union (C.I.O.) because its business was not of sufficient national importance to justify Board action. The company makes and sells concrete blocks and pipe; bought $133,000 worth of cement from outside the state, and sold products to the value of $2000 to $3000 outside the state. The employer's total sales amounted to $470,000 a year and of this $13,000 worth were sold to two companies engaged in interstate commerce.

Part of the text of the Board's decision reads: "It is clear that the operations of the employer affect commerce within the meaning of the Act, and that the Board could assert jurisdiction. We are concerned, however, not only with the question of whether the Board is empowered to exercise jurisdiction, but also whether it is administratively advisable to do so in a case of this kind. In the light of past Board decisions on this question, the only theory under which jurisdiction could be taken is that the employer furnishes goods valued at $50,000 a year or more to an instrumentality of interstate commerce. We do not believe that the concept of instrumentalities of interstate commerce should be so broadly construed as to encompass so remote an activity as the construction of county roads.

"While we do not now depart from the policy of asserting jurisdiction over enterprises which furnish services valued at $50,000 or more to direct instrumentalities of interstate commerce, we find that the construction of county roads is too remote an extension of that policy to warrant our taking jurisdiction here."

## Buys Gravel Property

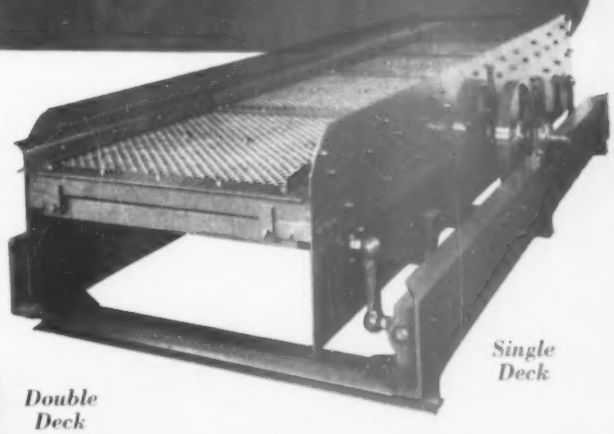
EAGLE CITY GRAVEL CO., Eagle City, Ohio, has purchased an additional 100 acres of gravel property adjacent to its present operations. Cost of the purchase was approximately $128,000.

## Moves Plant

THE KEYSTONE DIVISION of Dravo Corp. has announced the removal of its Freedom, Penn., plant to Railroad St., Rochester, Penn.

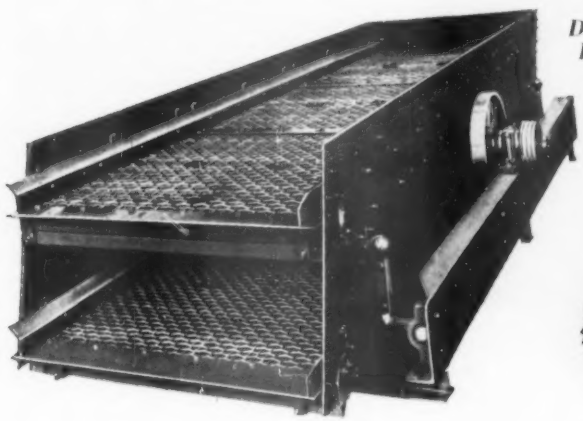
# Prepare NOW for more PROFITABLE AGGREGATE PRODUCTION

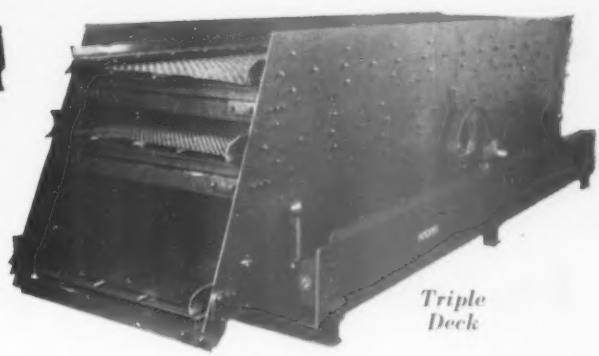
Pictured are 3 of over 300 Seco models for every screening need from scalping stone to screening ag-lime. Every Seco vibrating screen has patented Seco equalizer assembly for proven performance.



*Single Deck*

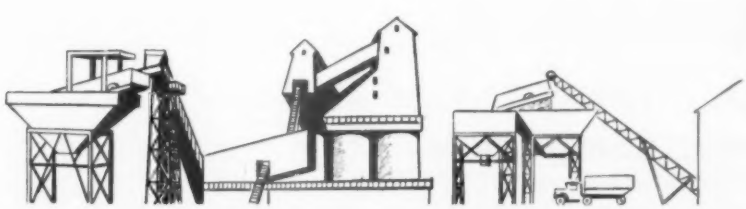
*Double Deck*





*Triple Deck*

Now is the time to replace obsolete or inadequate equipment with *performance-proven* Seco vibrating screens. Yes, every screening operation you entrust to a smooth Seco will result in better sizing, greater tonnages . . . and a real vacation from maintenance worries. In a few short words . . . *more* profit per ton for you.



*For information see your local Seco Distributor*

Get the facts! Send for Seco Catalog #203 and the name of your nearest Seco dealer.

**SECO**

**TRUE CIRCULAR ACTION VIBRATING SCREENS**

**SCREEN EQUIPMENT CO., Inc.**

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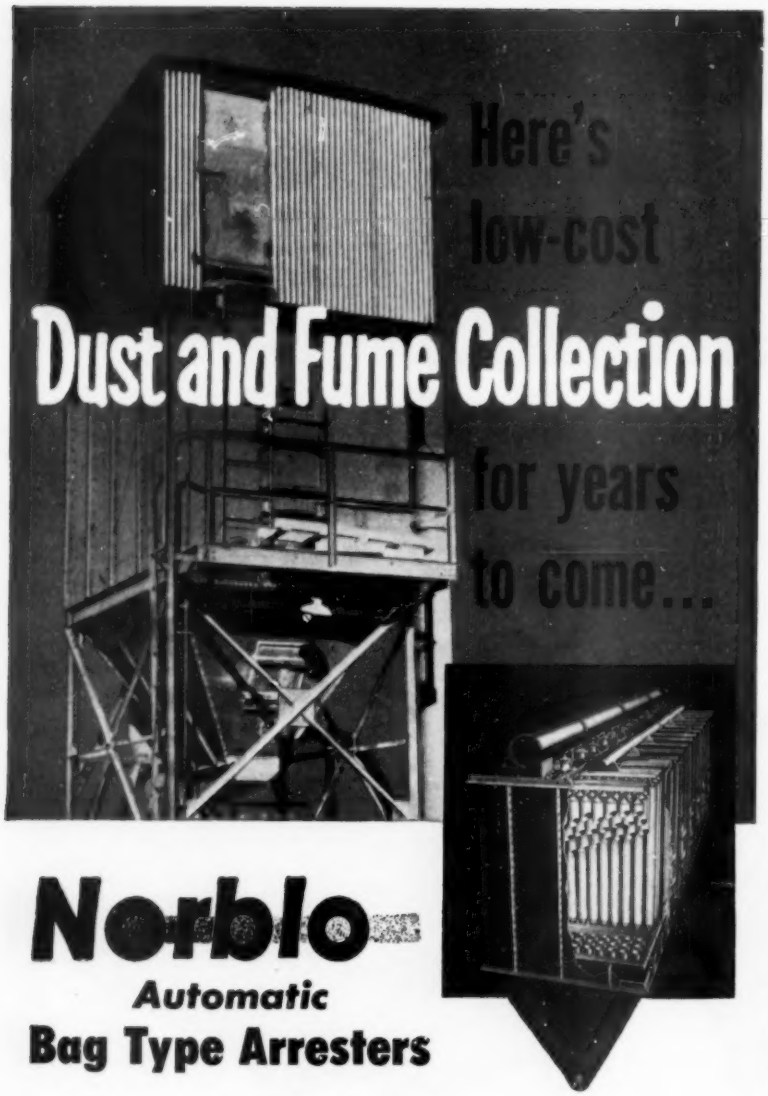


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**Bag Type Arresters**

Norblo equipment is based on sound, experienced engineering and takes full account of the *scale* of your operation as well as *time* factors, so that Norblo performance can be *guaranteed.*

Norblo arrester design is based on multiples of a basic, standardized compartment. Bag cleaning—fully automatic—is cyclic and periodic, taking only a few seconds for each compartment. In continuous, heavy duty operation, full calculated capacity of Norblo equipment is always available, and investment for equipment of any desired capacity is held to a minimum.

Norblo gives you all four essentials of low cost operation for years to come—advanced design, high efficiency, long life and low maintenance. Write for Bulletin 164-4.

**The Northern Blower Company**

Engineered Dust Collection Systems for All Industries

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## Coarse Agstone

*(Continued from page 97)*

of farm lands evidently wish for an instantaneous liming material. But the many reasons why liming may not show significant benefits for two, three or four years after application are cited by Dr. F. G. Merkle, of Penn State. He says: (ROCK PRODUCTS, June 1953)

"In the first place, the first application to be applied on a thoroughly acid soil should be *more* than the measured *agricultural limestone requirement.* This is necessary because limestone is not water soluble. It must slowly dissolve on its surface. Then the soil acidity must dissociate into the soil moisture. Then the calcium and the colloidial acids must combine. All this does not take place quickly in a soil having only 15 to 20 percent moisture.

"The writer has limed many acid soils up to their full lime requirement in May only to find that by mid-summer a very slight change had taken place in the pH value of the soil. The saturation of winter and spring helps much to accelerate this reaction. Hence, the failure of the application to bring the desired results the first or even the second year and the necessity of making the initial application generous.

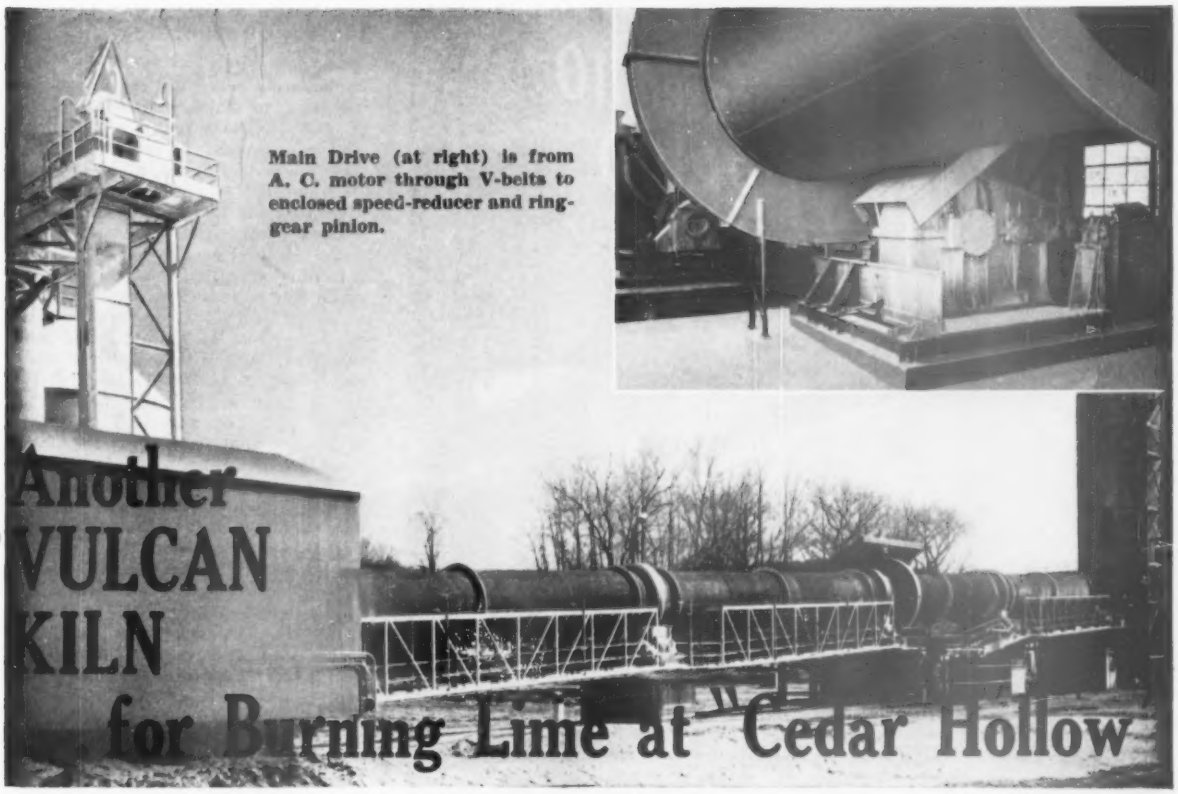
"Then also lime must transform the microbial population from the acid-tolerant type to the calciphile type. This likewise requires time.

"The soluble and dispersed iron, aluminum and manganese must be in-activated and this requires contact, moisture, and thorough mixing of the liming material with the soil. The farmer must appreciate that patience is required for fundamental soil building."

In view of these results, who can doubt that if similar studies were to be made on other corn-belt soils, it would be found that the coarse fraction would have an equally creditable record. We do not believe that there is any real basis for concern regarding the true value of the coarse particles in agricultural limestone. Pound for pound they are of equal or greater value than the dust.

## Agstone and Aggregates

WYMORE LIME & ROCK CO., recently formed by Donald Colgrove and Franklin Rutan, has leased the Davis quarry at Wymore, Neb., and has started agricultural limestone and crushed stone operations. A large pile of screenings was left at the quarry from crushed stone operations conducted during the war. Tests taken from the screenings showed a high calcium carbonate content, prompting the new company to separate the finer material for agstone purposes, and the coarser for aggregate. When the screenings have been depleted, the company expects to have a crusher to handle continued operations.



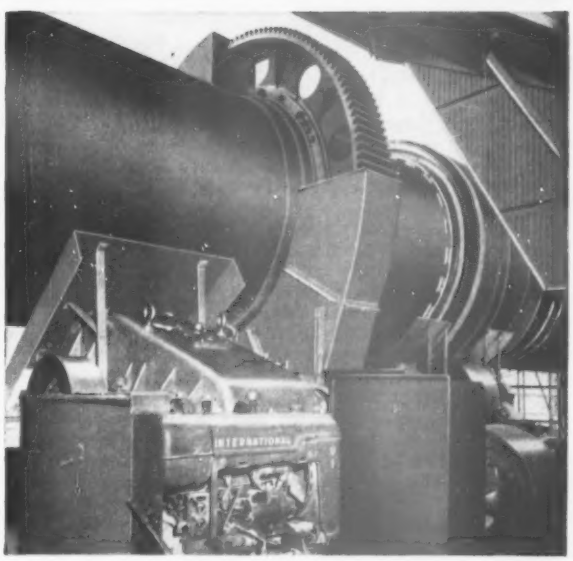
Main Drive (at right) is from A. C. motor through V-belts to enclosed speed-reducer and ring-gear pinion.

# Another VULCAN KILN for Burning Lime at Cedar Hollow

When the Warner Company's Cedar Hollow, Pa. plant first went into operation, in 1916, it was equipped with an 8′ x 150′ Vulcan Rotary Kiln which is still in operation and still giving good service. To meet the need for greater capacity, however, another Vulcan Rotary Kiln has recently been installed as shown in the illustrations.

The new kiln is not only much larger (9′ x 300′) but also embodies every modern feature to assure efficient, economical operation. The very heavy all-welded steel shell is mounted on our latest-type supporting roller and thrust bearings; all of which are automatically lubricated and easily adjusted to compensate for wear or moderate misalignment. Main drive and auxiliary drive both have an ample margin of power over any probable requirement and are as fully enclosed as possible, to promote cleanliness and safety. Other features, specified by the Warner Company's experienced engineers and production executives, assure maximum capacity and minimum fuel consumption under their particular operating conditions.

Detailed information regarding Vulcan Rotary Kilns for lime plants, cement plants, and other modern applications is given in our 28-page, fully illustrated, bulletin No. A-442. Write for it if you can use it to advantage.



Auxiliary Drive (above) is from gasoline engine through Morse clutch-coupling and V-belts to same enclosed speed reducer as for main drive.

## VULCAN IRON WORKS

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| Rotary Kilns, Coolers and Dryers | Double-Roll Briquetting Machines | Heavy-Duty Electric Hoists | Steam Locomotives |
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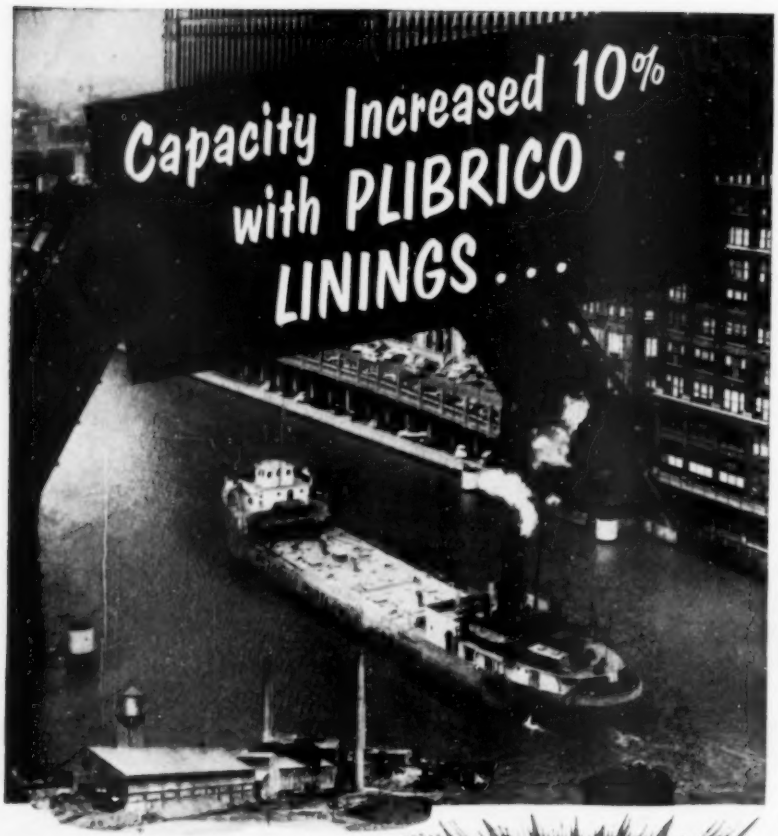
| Improved Vertical Lime Kilns | Steel-Plate Fabrication | Scraper-Loading Hoists | Diesel-Electric Locomotives |
| Automatic Quick-Lime Hydrators | Shaking-Chute and Chain Conveyors | Cast-Steel Sheaves and Gears | Electric Locomotives and Larrys |




THE BIG freighter *John L. A. Galster,* out of Petoskey, Michigan, bringing a cargo of cement into Chicago, is a colorful representative of one of the world's outstanding cement manufacturers, the Petoskey Portland Cement Company.

The Petoskey story goes back more than 30 years — a story of constant effort directed toward increased efficiency. In 1950, seeking a way to derive peak performance from their four Edge Moor waste heat boilers, Petoskey engineers developed a long-range reconstruction program.

As the first phase of their program, they called upon Plibrico Sales & Service Company, Grand Rapids, to reset the first of the boilers. Plicast castable refractory was used to form a monolithic lining. This, together with the installation of Beco-Turner baffles and Plibrico Multi-Rib steel casing which formed an air-tight setting, resulted in an *overall steam capacity increase of 10%!* On the strength of this increased efficiency, Plibrico was asked to reset all the remaining Petoskey waste-heat boilers.

Of the thirteen grades of Plicast made, each suitable for a different application, several were required in relining the Petoskey boilers. Some were chosen for light weight, others for maximum strength or abrasion resistance, and all with outstanding refractory effectiveness.

Near your plant there's a Plibrico Sales & Service organization office, where you can get complete information. Or, if you prefer, write or call us for details and your copy of "9 Ways to Reduce Your Waste in Kilns and Dryers."

**Plibrico Company**

1832 Kingsbury Street, Chicago 14, Illinois

PLIBRICO SALES & SERVICE IN PRINCIPAL CITIES

**REFRACTORY PRODUCTS • ENGINEERING • CONSTRUCTION**

## Lime Manufacture

*(Continued from page 114)*

immediately below the regular calcining zone, to which a limited amount of gas (primary gas) is admitted. This may be half, or even less, of the total amount required, and only sufficient so that when burned with the preheated air passing up the cooler, a temperature just sufficient to continue terminal calcination is held.

Fig. 1, which at "A" reveals the maximum potential temperature as a result of complete combustion, with no excess air, in an athermal zone, shows at "B" the temperature resulting if combustion would be with 100 percent and at "C" 200 percent of excess air. The reduction is rather great, and that is the purpose of the finishing zone.

There are other special advantages to this supplementary zone besides lower temperature. Terminal calcination is in a zone of lower $CO_2$ concentration at which, due to the law of gaseous diffusion, a lower temperature for the same calcining rate is needed. Then the atmosphere is oxidizing rather than reducing and not as conducive to formation of undesired compounds. A third advantage is that lime breakage is less, as ordinarily much of it is due to surface shrinkage while terminating calcination at high temperatures.

### Radiant Zone

The remainder of the combustible gas is admitted at a point above the finishing zone. For temperature control and other reasons, the amount of this gas is in excess proportion to the air coming through the finishing zone. While a state of excess air results in lowering temperatures, a state of incomplete combustion also does and in addition it is only through limited incomplete combustion that the long, luminous heat projecting flame, so desired by the old lime men, is obtained.

This zone could also be called the "high temperature zone," but it is not really high in temperature, due to incomplete combustion and due to core which is present here in considerable amount and exerts a strong temperature lowering influence. The temperature is higher by several hundred degrees than that of the finishing zone, but the relatively incompletely calcined lime can stand it without damage.

There is an excess of gas and, since combustion must be complete, at the apex of the radiant zone the required additional quantity of air is introduced in a forceful, turbulent manner so as to terminate combustion sharply and well within the calcining zone.

This combustion system is odd and novel, the lengthening out of the calcining zone, and within it, of the combustion zone, as well as the introduction of gas at two points and its combustion at three; that is, at the primary gas, the secondary gas and

# This Simplicity screen has already produced 6,150,000 tons limestone!

**Simplicity Model D Double Deck Screen at McDonough Bros. Stone Company helps produce specially prepared limestone for metallurgical applications**

This 4′ x 12′ Simplicity Double Deck Screen at McDonough Bros. Stone Company in San Antonio, Texas, has already produced more than six million tons of metallurgical limestone. And it's still going strong. A 24″ belt conveyor, running at 600 feet per minute, delivers 300 to 400 tons of limestone an hour to a crusher. Then the Simplicity Gyrating Screen separates the plus 4½″ material on the top deck and the plus 2⅝″ material on the bottom deck. Simplicity Screens, like those in operation at McDonough Bros., can help insure fast, accurate sizing and processing in your plant. And the simplified power and operating mechanism of Simplicity equipment helps keep maintenance costs down. For complete information, consult a Simplicity sales engineer or write us today.

137

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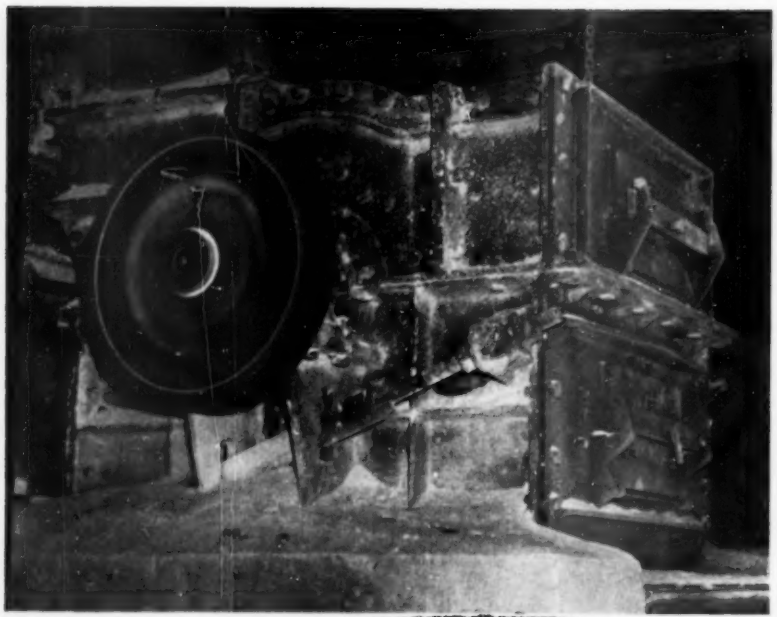
**ENGINEERING COMPANY • DURAND, MICHIGAN**



1,150,000 TONS OF STONE CRUSHED WITH A PARTS-DISPLACEMENT COST OF ONLY 1/3¢ PER TON

**AMERICAN ACS-4 HAMMERMILL at Missouri Quarry gives proof of BUILT-IN QUALITY**

At a large Missouri Quarry, this rugged American Hammermill keeps parts-replacement — and stone crushing costs — down to a minimum.

That's because Americans are built to last — with heat treated alloy steel main rotor shaft . . . heavy-duty Timken Bearings enclosed in dust and oil-tight pillow blocks . . . heavily ribbed sectional frame for vibration-free operation and easy accessibility and adjustability . . . all-manganese steel crushing parts for longer wear.

From agstone to roadstone sizing, Americans offer the flexibility and consistent sizing control that make every reduction job more efficient as well as more profitable.

SEND for your copy of "BETTER STONE CRUSHING"

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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the termination air entrance points. In this connection we should remember that in any open fire, there are long flames, and short flames that tend to lean over to the long. When oxygen is adequate they are short, hot, but quickly cooling. Where air is insufficient they are more slowly cooling and, on cooling, terminate in smoke or at least CO gas.

Somewhat the same occurs in any vertical kiln. Some flames therein are longer and some are shorter. As there is less chance for the long flames to get the air in such packed beds they may extend high up, even into the preheating zone, there to be chilled and before burning be snuffed out. The tendency may be even more pronounced because there is little lateral mixing, and the higher the velocity of the gases and the smaller the stone the less mixing there is. If the gas does not get the required air at its entrance, chances of it getting it later are small.

To give enough air to the long flames would be giving too much to the short which also has its objections. Perfect distribution of gas with the air would also seem to be the answer, but perfect distribution means the temperature of perfect combustion and a very short calcining zone.

The aim therefore is to admit surplus gas, allowing all flames to be long, although some will be longer than others. Then at a point where temperature is still high enough for combustion, but not high enough for damage, admit high pressure air, preferably preheated, in slightly more than adequate amount, in a manner disturbing to the region, contributing to positive mixing and to completion of all combustion, positively, quickly, and all on one level of kiln height, still within the calcining zone and below the preheating zone junction.

By the use of termination air at high pressure, the amount of necessary excess air is reduced through increased turbulence and better mixing.

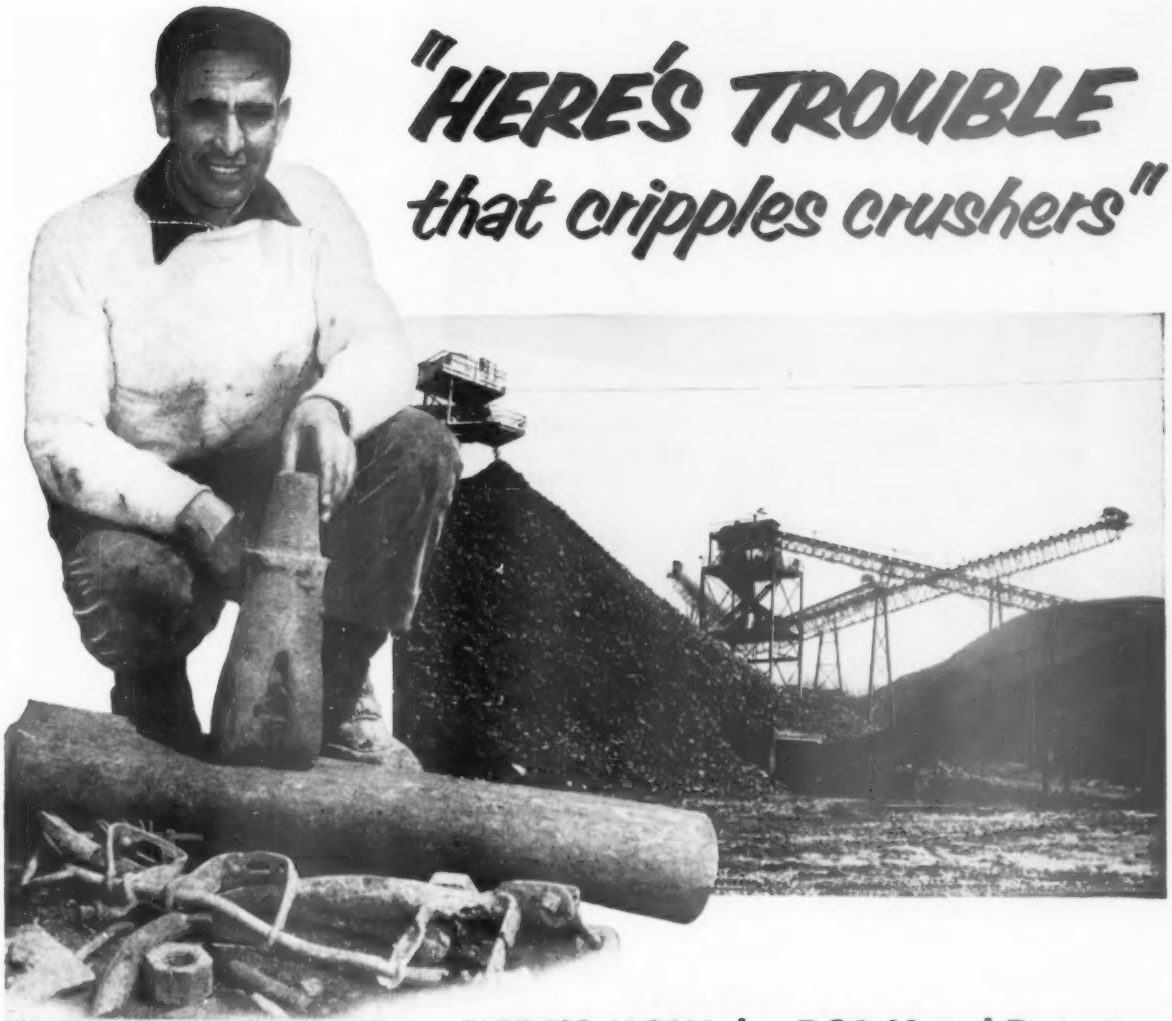
In this manner, the maximum heat is developed as well as absorbed within the calcining zone and the gases will be at the lowest possible temperature differential when leaving the point of incipient calcination. It also could be stated that the "calcining zone terminal temperature differential" was at the minimum, which in turn results in lowest of exhaust temperatures.

Diagrams "A" and "F," with descriptions were prepared in the simplest manner to further help to visualize why lime is overburned and how this may be prevented. Much grief could have been avoided if all this would have been understood 20 or 30 years ago.

## Stone Quarry Opens

THE TECON CORP., of Dallas, Texas, has opened a $150,000 crushed stone plant north of Sedalia, Mo.

# "HERE'S TROUBLE that cripples crushers"



**At Kingston Trap Rock Company,** Kingston, N. J., the RCA Metal Detector is on the job, cutting shutdowns and saving crushers by preventing damage from tramp metal.

## HERE'S HOW the RCA Metal Detector CUTS CRUSHER SHUTDOWNS

Extra-hard tool steels—bits, digger teeth, and other tramp metal—have ways of getting past even the most conscientious inspector—*but they can't escape the RCA Electronic Metal Detector.*

Installed on your conveyor, the RCA Metal Detector probes through rock to locate metals and alloys (including hard-to-detect manganese)—sounds an alarm or stops your conveyor—to keep trouble away from your crushers.

**PAYS ITS WAY AGAIN AND AGAIN**

By saving high-cost crusher replacements—by preventing the waste of shutdowns—the RCA Metal Detector can actually pay its way every day in the week. Start cutting shutdowns now—send for information today.

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**RADIO CORPORATION of AMERICA**

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Please send me information on the RCA Metal Detector.

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Company_____

Address_____

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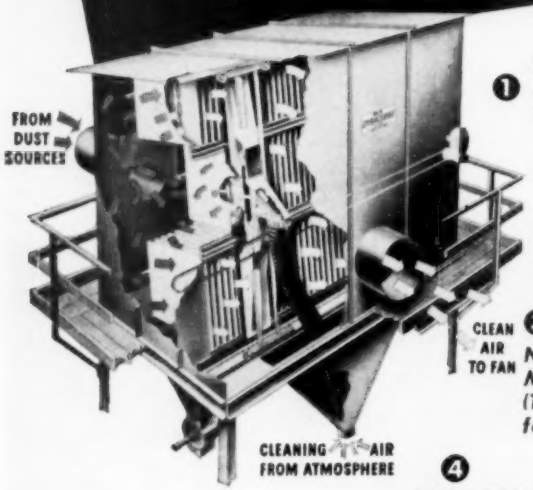
DYNACLONE®
PATENTED
The ULTIMATE in Dust Filters




1 CONSTANT SUCTION at dust sources.

2 SELF CLEANING for continuous operation.

3 NO AUXILIARY MOTORS or BLOWERS (The main operating fan does the cleaning).

4 NO ABRASION of BAGS by the CLEANER.

5 LESS OVERALL HEIGHT and FLOOR SPACE.

HOW IT OPERATES

(a) Dust laden air is drawn in from the dust sources as indicated by the shaded arrows.

(b) It is diffused into the dust chamber by the baffle plate.

(c) It is then drawn through the fabric of the filter bags and is cleaned as shown by the clear arrows.

(d) Clean air passes out of the case and goes to the suction fan.

(e) Concurrently, the traveler moves back and forth across the dust wall registering successively with one bag at a time.

(f) The suction which exists in the dust chamber draws a blast of atmosphereic air through the bag in reverse directions and cleans that bag. (No shaking.)

Control your industrial dust better, for less — with the Sly Dynaclone. May we explain how?

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SLY PIONEERS & LEADERS in INDUSTRIAL DUST CONTROL

## Industrial Sand Meeting

(Continued from page 117)

Creek Sand Co., Morgantown, W. Va., was honored by the association by election as honorary member of the board of directors for his long and faithful service to the organization.

### Review of Washington Scene

Vince P. Ahearn, executive secretary of the association, gave his very illuminating picture of events in Washington and the impact which they are having on the country. He mentioned that President Eisenhower is still popular but certain members of his official family are not so popular. The President, he said, has tried to delegate more authority to Vice-President Nixon and cabinet members, sometimes with unfortunate results. He is faced with the enormous task of balancing the budget and continuing an adequate defense program. Mr. Ahearn reviewed some of the outstanding happenings as the return of title to the States in the off-shore oil legislation, the ending of controls, the abolishment of the R.F.C., the refusal to make amendments to the Taft-Hartley Act desired by unions, and farm supports. Mr. Ahearn referred to the charges that Republicans are favoring big business and lacking in sympathy for labor. He also discussed Sen. McCarthy and communism. He referred to the great loss the country had suffered in the death of Sen. Taft. In conclusion Mr. Ahearn touched upon the depletion of our natural resources with relation to our increasing population.

## Rotary Kiln Inserts

(Continued from page 121)

and by the use of suitable brick for these inserts the units have proved themselves perfectly stable up to temperatures of 1200 deg. C. Less severe service demands on the kiln lining, saving of fuel, and increased kiln loading are obtained beyond all doubt; this was also found by Azbe with his type of construction.

The turning over and forward movements of the raw material feed in the lens shaped pockets of the Dietze inserts considerably reduce demixing of the raw material. Accordingly a uniform clinker grain is formed and far higher strengths can be obtained in the cement produced; this has been established in actual production.

Dietze uses another device which is of further importance. In the theoretical consideration of this matter, it has already been pointed out that on account of the material thickness of the inserts, a reduction in the cross sectional area must be accepted, although this is not significant. This has an effect on the gas velocity. Dietze has arranged the channels not as closed continuous channels running the whole length of the built-in unit, but as segments offset 20 deg.

# This brick slashed reline time 75%!

HERE's a report on a recent check of hot zone linings in rotary cement kilns now using Permanente Periclase-Chrome bricks:

**At five plants selected at random from our customer list—with capacities ranging from 1,200,000 to 3,500,000 barrels per year—Permanente Periclase-Chrome brick linings cut down-time for relining an average of 75% compared to the linings previously used!**

In each of the five plants, Permanente Periclase-Chrome brick improved service—gave an average of 10 months service compared to an average of approximately 2 months with the other type brick. In addition, fewer shut-downs resulted in substantial savings in cost of materials for relining.

Such exceptional performance was possible because Permanente Periclase-Chrome bricks are *especially designed* for hot zone linings. This special design is the result of 10 years experience working with cement kilns throughout the country. Today, it's *your* best bet for higher production.

**SEND FOR BOOKLET** giving installation procedures and for literature explaining all the advantages of Permanente Periclase-Chrome bricks. If an appraisal of your kiln performance would be helpful, Kaiser Chemicals will be glad to work with you. Installation service at no extra cost. Standard brick sizes available, both burned and chemically bonded. Complete facilities insure superior service. Call or write principal sales offices: *Chemical Division*, Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California. First National Tower, Akron 8, Ohio.

**Kaiser Chemicals**

Pioneers in Modern Basic Refractories

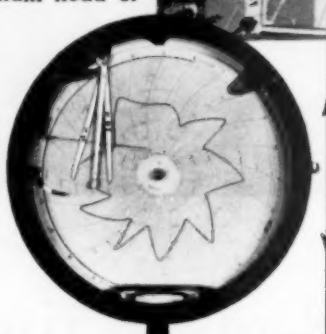
**Basic Refractory Bricks and Ramming Materials - Dolomite - Magnesia - Magnesite - Alumina - Periclase**

Don't lose your "head"!

. . . Let Foxboro control tank-water level at the pump

EVEN WHEN SUDDEN, EXCESSIVE DEMANDS HIT your water supply system, you can depend on the Rotax Altitude Controller to keep a safe head of water in the storage tank.

This weather-proof watchman operates right at the pump . . . eliminates tank-to-pump wiring. The Rotax Controller starts the pump when line pressure drops below pre-set limit — whether due to minimum head or high withdrawal rate. It stops the pump when tank is full . . . doesn't waste water in overflow. In addition, the instrument provides a continuous chart record of water level as an aid to efficiency checks.



Write for full information or consult your Foxboro Field Engineer.

The Foxboro Company, 3012 Norfolk St., Foxboro, Mass.

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Pulverizers

Have you investigated our new BRADLEY HERCULES MILL? Unquestionably the last word in Economy and Simplicity.

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BRADLEY PULVERIZER CO.
ALLENTOWN, PENNA.

every 3 to 4 meters. In a 21-meter run of the built-in construction there is a draft loss of only 1.5 percent.

This type of construction forces the gas to take a spiral path through the kiln, and the resulting greater travel length balances out the disadvantage of the effective cross sectional reduction with its higher gas velocities.

In addition, the interruption of the segments at regular lengths and the continuation of the next segment in the position offset from the previous one serves to interrupt the regular flow passage of the three material flow paths and to redistribute them. In this way, the material is continually gliding along the walls, and thus is not subjected to any throwing effect so that no increased dust generation occurs.

Because of the segment design shape and its consequent improved thermal absorption, these inserted units improve the preparation of the material for the sintering stage and in addition avoid the undesirable rings in front of the sinter zone.

Therefore it is not saying too much when Dietze claims that his type of kiln insert unit achieves better thermal utilization, manifested by lower fuel requirement. Furthermore, ring formation is avoided and the kiln lining is not so severely loaded because of better preparation of the material, and because of smaller material flow thicknesses. Finally, the kiln output itself can be increased. These facts are also claimed by Azbe and from figures given by this worker, this claim is evidently true.

It is actually secondary as to whether it is more useful to divide the kiln internally into three or four subsections by means of inserts. The principle of both the Dietze and Azbe constructions is the same. Zollinger mainly questions Azbe's assertion that his construction is something entirely new. As was mentioned above, kilns using the Dietze design have been in operation in Germany for years and have proved their practicability under operating conditions.

## Studies Asbestos Deposit

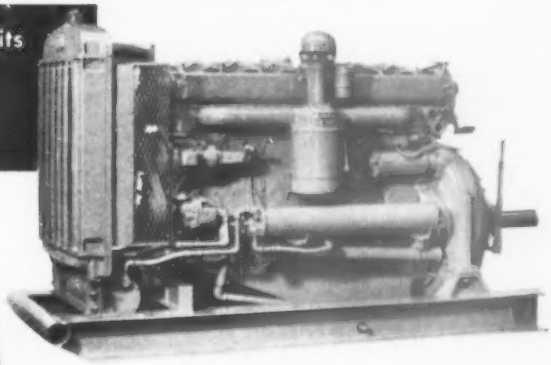
NATIONAL GYPSUM Co., Buffalo, N.Y., which entered the field of asbestos products during the past year, is currently studying large asbestos deposits at St. Adrian de Ham, Quebec, for possible financial investment, according to Melvin H. Baker, chairman of the board.

The asbestos property under study is owned by Dominion Asbestos Mines, Ltd., which was incorporated in 1950 and started asbestos mining operations last June. National Gypsum has ordered 100 tons of asbestos fiber from the company for testing purposes, and also has engineers and a geologist on the property to study the quality of the deposits, ore reserves and future possibilities of this new property.

# Wherever you are

**you will find MURPHY DIESEL**
**sales, parts and service facilities**
**convenient, prompt and dependable**

**Engines and Power Units**
**Generator Sets**
**Mech-Elec Units**
90 to 240 H.P.
60 to 140 K.W.



**Genuine Factory Engineered Parts**
Strategically located stocks of genuine Murphy Diesel parts minimize down time for repair or overhaul

**Factory Trained Service Specialists**
Dealer servicemen are trained in the newest and best service techniques right in the Murphy factory

**MURPHY DIESEL COMPANY**
5315 W. Burnham St.
Milwaukee 14, Wisconsin

253

MURPHY DIESEL

## *Heavy duty power* for rock crushing

Murphy Diesel engines and power units are available in sizes from 90 to 226 H.P. Engine speeds are 1200 and 1400 rpm.

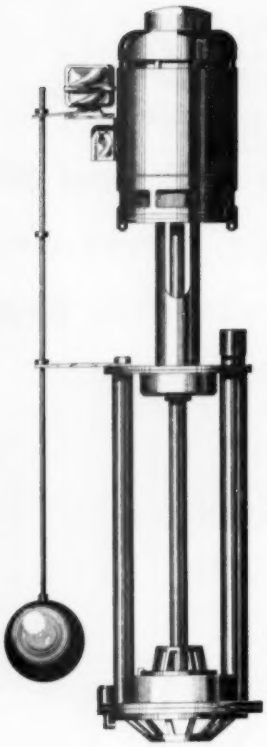
"Packaged" generating units are available with capacities ranging from 60 to 140 K.W. A.C. or D.C. voltages.

**Put This Sump Pump On Your Toughest Job!**

That's what it's built for . . . the most difficult sump pumping operations ever encountered. It takes all ordinary jobs easily in its stride. Handles acid sludges, corrosive and foamy products with solids in suspension. Suitable for abrasive pulp and acid transfer in mills and smelters, floor cleanup in chemical plants, draining and filling acid tanks. Completely rubber lined and covered for acid handling.

The Galigher Sump Pump has no submerged bearings or packings that often cause trouble. Oversize particles are effectively screened out. Pump has no tendency to airlock. Handles heads up to 35' and flows up to 75 g.p.m. Write us for full details.

We also have the full line of VACSEAL PUMPS—vertical and standard types. Ask for illustrated bulletin.



**Galligher Sump Pump**

*Leaders in Experience & Service*

**THE GALIGHER CO.**

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**forged** STEEL DROP BALLS

FOR ECONOMICAL SECONDARY BREAKAGE

Prices and information on request
Available 2000 to 8000 lbs.

CAPE ANN ANCHOR & FORGE CO.
P.O. BOX 360, Gloucester, Mass.


## NEW INCORPORATIONS

**Ross Sand Co.**, Concordia, Kan., producer of sand, gravel and ready-mixed concrete, was recently incorporated with an authorized capitalization of $250,000. Officers of the company are Ellis Ross, president; Meryl Holsted, vice-president; James L. Day, secretary-treasurer; and Harvey Hoelscher, Jack Strait and DeWain Loeffler, members of the board of directors.

**Hedberg Concrete Co.**, Minneapolis, Minn., has been incorporated by Fred W., Dorothy E. and John W. Hedberg, who will also compose the first board of directors. The company will deal in sand, gravel, concrete and other building materials. The firm of Hedberg-Freidheim Co., Minneapolis, has been dissolved.

**Kalamazoo Ready-Mix Concrete Co.**, Kalamazoo, Mich., has been incorporated by B. L. and Joseph D. Proxmire and Joseph Taffee. Capital stock consists of 5000 shares of common stock, $10 par value. Capitalization was listed at $15,000.

**S. A. Fones, Inc.**, Baxter Springs, Kan., has been incorporated by S. A., Margaret A. and Elizabeth W. Fones. Capitalization was listed at $10,000. The company will deal in chat, sand and stone.

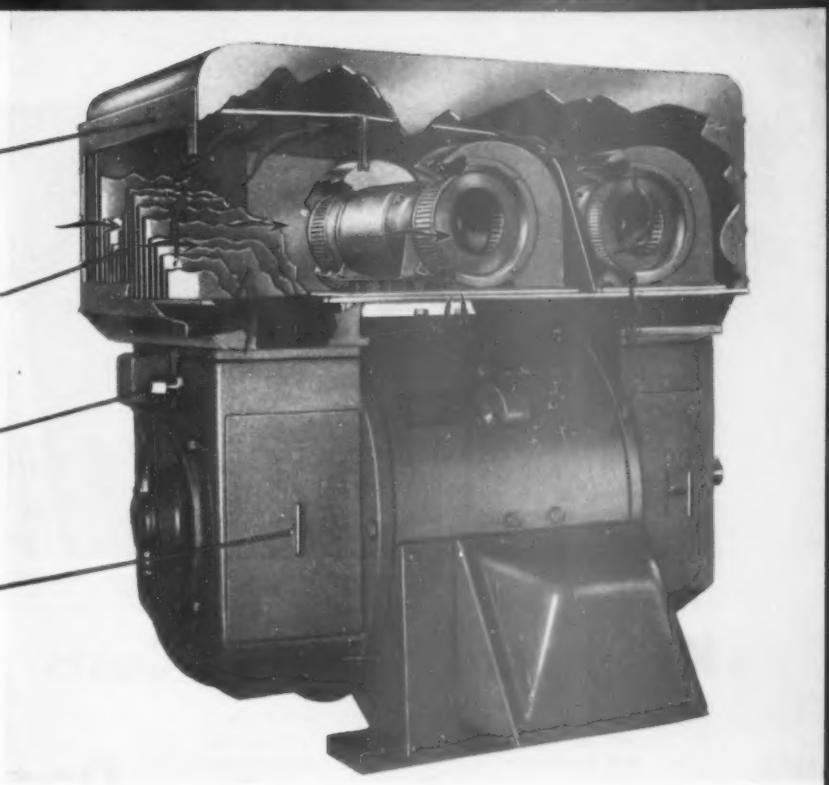
**Cooper Concrete Co.**, Garland, Texas, has been incorporated with $10,000 capital stock. Randall Cooper, Cecil Cooper and Grady Cooper are the incorporators.

**General Concrete Products Co.**, Baytown, Texas, has been incorporated by W. Lawson Lee, Gilbert A. Reidland and Frank O. Gregory. Capital stock was listed as $20,000.

**Bowden Concrete Products, Inc.**, Memphis, Tenn., has been incorporated with 100,000 shares of common stock, $1 par value, and an initial capital of $10,000. Hillsman Taylor, Mrs. J. B. Bradley and Robert L. Taylor are the incorporators.

## Portland Cement Production

THE PORTLAND CEMENT INDUSTRY produced 23,795,000 bbl. of finished cement in September, 1953, as reported to the Bureau of Mines. This was an increase of 3 percent compared with the output in September, 1952. Mill shipments totaled 27,417,000 bbl., an increase of 4 percent over the September, 1952 figure, while stocks were 34 percent above the total for the same month in 1952. Clinker production during September, 1953, amounted to 22,235,000 bbl., an increase of 0.5 percent compared with the corresponding month of the previous year. The output of finished cement during September, 1953, came from 156 plants located in 37 states and in Puerto Rico. During the same month of 1952, 23,010,000 bbl. were produced in 154 plants.


**COMPACT,** top-mounted cooling unit falls within the over-all length and width of main motor.
**SMOOTH** vertical plates are self-cleaning. Cooling unit is easy to remove for inspection.
**ROTECTIVE THERMOSTAT** helps afeguard main motor in case f blower-motor power failure.
**EASY ACCESS** to inspection opening—no tools required.

# General Electric Announces New Unit-Cooled D-C Motor!

## Smallest of type from 15-200 hp, new motor features 50% greater heat transfer in 37% smaller unit than previous design.

To meet your industry's need for a compact, totally enclosed motor, this new General Electric unit-cooled design features more effective heat transfer in a smaller unit.

Special construction assures dependable operation, with minimum maintenance, in the severe atmospheres which make open or partially enclosed motors difficult to maintain.

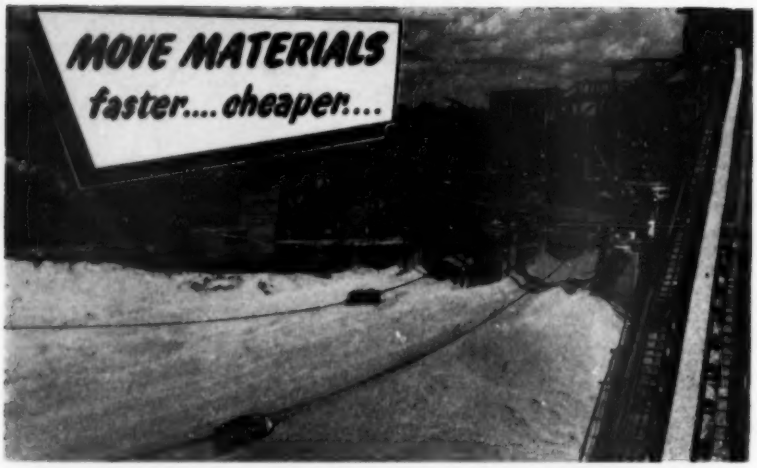
Shutdowns for cleaning and inspection are reduced to a minimum. Air-borne contaminants and foreign particles are kept out of the internal ventilating air by the totally enclosed construction

For additional information on ratings and dimensions, contact your nearest General Electric office or write for Bulletin GEA-6091, "Unit-cooled D-C Motors." Address Section 770-31, General Electric Company, Schenectady 5, N. Y.

**THE SMOOTH STYLING** of the new unit-cooled motor is in harmony with good machine design. Smooth contours facilitate cleaning. No ducts or piping are needed on this compact, ready-to-install unit.

*You can put your confidence in—*

**GENERAL ELECTRIC**




Since 1926, the Sauerman scraper machine pictured above has given efficient, economical service at the crushing plant of Wm. P. McDonald Corp., of Brookville, Florida. The plant consists of two 2-cu. yd. Crescent Scrapers operating on long stockpiles at adjacent angles.

# Keep Your Handling Costs Down

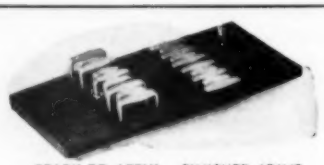
Simplify your job of handling materials—just as many other aggregate producers and producers of cement, lime and gypsum have done—by installing a Sauerman Drag Scraper.

Low in initial cost, Sauerman scrapers are noted for long dependable service, even under the most grueling conditions. Labor requirements are minimum . . . only one man is needed to operate these machines. Maintenance costs and power consumption are extremely low.

Whether your handling problems is excavating or stockpiling bulk materials, costs go down and stay down when a Sauerman Scraper is installed. Backed by more than forty years experience, our Engineering Department will advise and assist you in setting up an efficient, long-lasting and profitable operation.

Write Now for Above Catalogs

**SAUERMAN BROS., INC.**
530 S. Clinton St., Chicago 7, Ill.



READY TO APPLY FINISHED JOINT

TRADE MARK

*Clip-Lock-Rip*

The DUAL PURPOSE LACING for PATCHING and SPLICING

*No Special Tools Required:* JUST A HAMMER

**BELT LACING**
FOR: ALL CONVEYOR BELTING
¼" TO ⅞" THICK

*Write for Bulletin and Name of Jobber*

**THREE POINT BELT LACING CO.**
PEACE DALE, RHODE ISLAND
*Formerly Mfg. by The Bristol Co.*


## MANUFACTURERS NEWS

**Hercules Motors Corp.**, Canton, Ohio, has announced the election of John C. Keplinger as president of the company. A graduate of Cornell in 1914 with a B.S. degree, he joined Hercules in 1926 as sales manager. He became vice-president in charge of sales in 1931, elected to the board of directors in 1934, and executive vice-president in 1948. Charles Balough, one of the organizers of the firm, was named chairman of the board to succeed Gordon Mather, also one of the founders, who has retired. Other appointments include Lawrence G. Downey, vice-president; George W. LaSalle, vice-president; F. H. Geisler, director of sales; and Dr. E. A. V. Horiak, chief engineer.

John C. Keplinger

**United States Rubber Co.**, New York, N.Y., has announced the following changes in the sales department of the U.S. tires division: H. Newman Roberts, formerly district manager at Charlotte, N. C., has been promoted to southern division manager at Atlanta, Ga. He will also supervise the Atlanta, Charlotte, Dallas, Memphis, New Orleans and San Antonio districts. Walter F. Brown has been named manager of the north central division, with headquarters at Detroit. He will also be in charge of the Detroit, Buffalo, Cleveland, Grand Rapids, Indianapolis and Pittsburgh districts. Harry R. Mack moves from southern division manager to central division manager at Chicago, where he will also supervise the Chicago, Fargo, N. D., Milwaukee, Minneapolis and St. Louis districts. New district managers are Edwin W. Means, Charlotte, N. C., and Robert R. Walker, Philadelphia, who succeeds E. J. Bassine, who has resigned.

**Clayton Mfg. Co.**, El Monte, Calif., announces that E. S. Chapman has been appointed executive vice-president in charge of all operations; J. A. Cortright, vice-president in charge of sales; and Perry Arant, vice-president in charge of engineering.

**Bergen Wire Rope Co.**, Lodi, N. J., has announced the appointment of Robert S. C. Ernst as director of the sales and merchandising departments. The company also plans an extensive expansion program which includes the erection of new buildings and new servicing methods to improve customer service and deliveries of all types and sizes of wire rope.

**General Electric Co.**, Industrial Power Components Div., Plainville, Conn., announces that the former Trumbull electric department has been

# WHERE EXPLOSIVES RESEARCH PAYS OFF

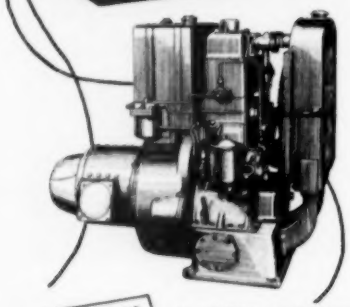
To blast 305,000,000 tons of stone and nonmetal materials for America's ever-growing construction, road building, and steel industries requires more than 166,000,000 pounds of dynamite annually. Here, as illustrated above, is where explosives research pays off. Note the excellent fragmentation which minimizes secondary blasting . . . the low stone pile which increases and speeds up the production of the shovels.

Such results come not only from specially developed explosives and blasting supplies, but also by using the most modern blasting methods. Hercules' continuous research and extensive knowledge of field conditions are important to economical and efficient blasting in quarrying, coal mining, metal mining, and construction.

***HERCULES POWDER COMPANY***

*Explosives Department, 946 King St., Wilmington 99, Del.*
Birmingham, Ala.; Chicago, Ill.; Duluth, Minn.; Hazleton, Pa.; Joplin, Mo.; Los Angeles, Cal.; New York, N. Y.; Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Cal.

You get more for your money with NORDBERG DIESELS



COST LESS TO OPERATE

In addition to the low initial cost of the 1, 2 and 3-cylinder Nordberg "4FS" series Diesel engines, the outstanding design and construction of these compact units assures extremely low fuel and lube oil consumption . . . which has been proved in a wide range of power jobs.

MORE 'EXTRAS'

Here are the "extras" that are all *included* in the low initial cost of Nordberg Diesel units: thermostatically controlled cooling system — heavy duty oil bath air cleaner — lube oil cooler — fuel and lube oil filters. *Compare* before you buy *any* 10 to 45 hp engine.

LONGER LIFE

Like all Nordberg Diesels, the "4FS" series engines are sturdily built to give years of reliable service with a minimum of maintenance time and expense.

Clip the coupon for details on Nordberg Diesel power units from 10 to 45 hp—Diesel generator units from 6 to 30 kw—or for Diesel pumping units in capacities from 200 to 3000 gpm at 15 to 240 ft. total head.

NORDBERG MFG. CO., Milwaukee, Wis.

NORDBERG

BUILDERS OF AMERICA'S LARGEST LINE OF HEAVY DUTY DIESELS

MAIL THIS COUPON TODAY

Nordberg Mfg. Co., Milwaukee, Wis.

Send catalog covering Nordberg Type 4FS Diesels. I am interested in a unit for the following service: RP

.....

Your Name .....

Company Name .....

Address .....

City ..... Zone .... State ....

4-553


expanded into the distribution assemblies department with Elmer T. Carlson as general manager, and the Trumbull components department, with Hershner Cross as general manager.

**Electric Storage Battery Co.**, Philadelphia, Penn., has appointed Roland Whitehurst as general manager of the industrial products division in addition to his duties as vice-president and director. Robert L. Sommerville has been named general manager of the automotive products division, with William C. Leingang as assistant general manager.

**Clark Equipment Co.**, Buchanan, Mich., announces that the following Midwest dealers will also handle Ross straddle carriers and fork truck lines: Modern Handling Equipment, Inc., Chicago, Ill.; Materials Handling Equipment Corp., Cleveland, Ohio; Material Handling Sales Corp., Detroit, Mich.; and Wisconsin Industrial Truck Co., Inc., Milwaukee, Wis.

**Atlas Powder Co.**, Wilmington, Del., announces that Richard M. Paget has been elected a director of the company. Mr. Paget is senior partner in the management consultant firm of Cresap, McCormick and Paget.

**Le Roi Co.**, Milwaukee, Wis., has appointed Paul D. Sullivan as manager of contractor sales for the construction and mining division.

**Minnesota Mining & Mfg. Co.**, St. Paul, Minn., has announced the appointment of Donald R. Guthrie as assistant general manufacturing manager of the coated abrasives and related products division.

**Society of Industrial Packaging and Materials Handling Engineers**, Chicago, Ill., announces that Stanley Price of Western Electric Co., Chicago, has been elected chairman of the board, and Earl B. Candell of the lamp division of General Electric Co., Cleveland, has been named president of the association.

**Wall Colmonoy Corp.**, Detroit, Mich., has announced the appointment of Elmer J. Lell as sales manager. He has been assistant sales manager since 1951.

**The Bristol Co.**, Waterbury, Conn., has appointed Ernest Nuber as sales manager of the instument division. He was formerly manager of the application engineering department.

**Colorado Fuel & Iron Corp.**, New York, N.Y., has announced opening of its new $30,000,000 seamless tube mill at Pueblo, Colo., which will serve Oklahoma, Kansas, Wyoming, west Texas, the Pacific Coast and western Canada.

**Koehring Co.**, Milwaukee, Wis., has announced the appointment of S. A. Witte as sales representative in Texas, New Mexico, Colorado, Oklahoma and Louisiana, with headquarters at Houston, Texas. George E. Schmidt


AMERICAN FORGE GRINDING BALLS

Heat treated Chrome-Moly or Carbon Steel 3/4" to 5"

Try AFCO balls. See for yourself how they grind longer and more efficiently, how they reduce grinding ball consumption. Write, wire or phone NOW for prices.

"AFCO"

AMERICAN FORGE CO.

Executive offices and plant: Niles, Calif.
Phone Niles 3311
Sales offices:
101 Park Ave., New York City
Portland, Oregon
Los Angeles, Calif.
Salt Lake City, Utah

6

## SOMEDAY . . . *it will be for real!*

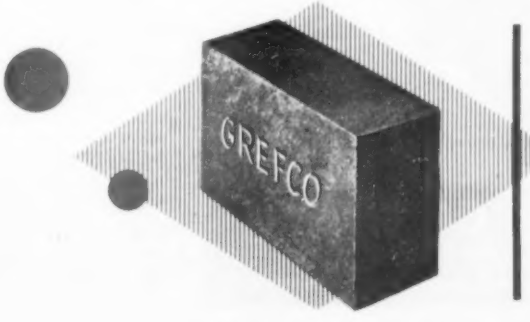
Building with blocks is as much a part of a young boy's life as baseball will be in his teens. Blocks—one on top of the other—to satisfy the typically male urge to create.

As the years roll by, this boy will go on to build bridges or buildings, to make his career in the laboratories of chemical research—or to watch steel being born from ore and earth.

Whatever his future, there will be refractory brick to help him do his job. Blocks of brick to line the furnaces and heat containing vessels—in virtually every step of industry.

There would be no processed raw materials, no production, no living such as we know it but for refractory products which Grefco furnishes in quality and quantity to keep the nation on the move.

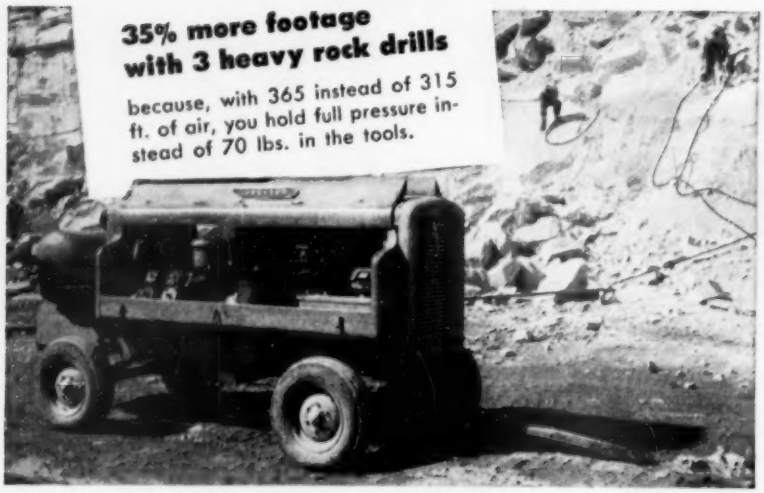
To the boy above, a very Merry Christmas and a great many Happy and Prosperous New Years. In his hands lies the future of America.




**GENERAL REFRACTORIES COMPANY**
**Philadelphia**

same men, same tools do

4 days' work in 3



35% more footage with 3 heavy rock drills

because, with 365 instead of 315 ft. of air, you hold full pressure instead of 70 lbs. in the tools.

75 ft.
125 ft.
185 ft.
250 ft.
365 ft.
600 ft.

JAEGER "Air-Plus" COMPRESSORS

deliver 15% to 25% more 100 lb. air at lowest cost per cubic foot of any compressors on the market, to run tools at their full efficiency.

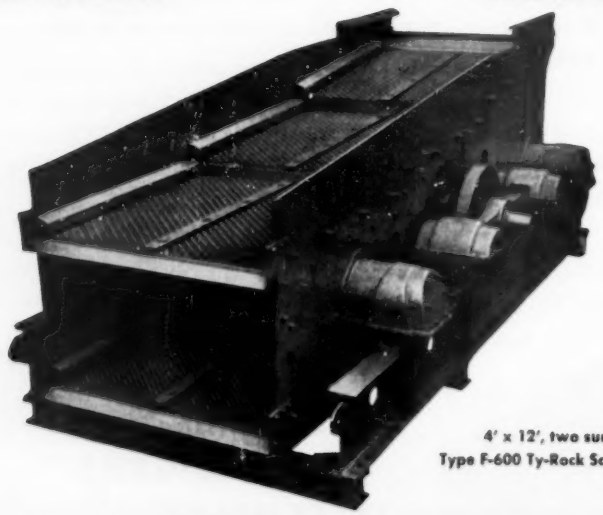
THE JAEGER MACHINE COMPANY 603 Dublin Avenue Columbus 16, Ohio

PUMPS • MIXERS • TRUCK MIXERS • PAVING SPREADERS and FINISHERS

YOU CAN DEPEND ON

TY-ROCK SCREENS

BALANCED RUGGED



4' x 12', two surface
Type F-600 Ty-Rock Screen

THE W. S. TYLER COMPANY

CLEVELAND 14, OHIO

Manufacturers of Woven Wire Screens and Screening Machinery


has been named sales representative in Wisconsin, Michigan, Ohio, western New York and western Pennsylvania, with headquarters in Milwaukee.

**Borg-Warner Corp.**, Chicago, Ill., announces that Harry J. Scott has joined the Pesco products division at Bedford, Ohio, as a sales engineer specializing in automotive hydraulic steering applications. He was formerly with the Saginaw steering division of General Motors Corp.

**Stearns Mfg. Co., Inc.**, Adrian, Mich., announces that M. F. Ledford has been appointed sales manager. He was formerly assistant sales manager and will be succeeded in this position by John L. Tuttle who has been in charge of the purchasing department.

**Schield Bantam Co.**, Waverly, Iowa, has announced the appointment of R. A. Otterness as northwestern district manager in Idaho, Oregon, Washington, Montana, the provinces of British Columbia, Alberta and Saskatchewan in Canada and two distributor branches in Alaska.

**Dodge Mfg. Corp.**, Mishawaka, Ind., celebrated its 75th anniversary recently at a plant Open House and civic testimonial. A bronze plaque was presented by Mayor E. Spencer Walton to Joseph E. Otis, Jr., president, on behalf of the City of Mishawaka.

**The Baker-Raulang Co.**, Cleveland, Ohio, manufacturer of fork lift trucks and cranes, is celebrating its 100th anniversary this year. J. W. Moran is president of the company.

**The White Motor Co.**, Cleveland, Ohio, announces a $2,000,000 modernization program for the new Autocar division in Exton, Penn. Edward F. Coogan, president of Autocar since 1949, has been named vice-president in charge of the division.

**Sauerman Bros., Inc.**, Chicago, Ill., announces the appointment of Martin Meyer as general sales manager to succeed Dwight D. Guilfoil who passed away recently. Mr. Meyer has been assistant sales manager for the past 10 years.

**Blaw-Knox Co.**, Pittsburgh, Penn., has announced a preliminary agreement for acquisition of all outstanding stock of the All Purpose Spreader Co., Elyria, Ohio, manufacturers of Apsco equipment.

**Sterling Electric Motors, Inc.**, Los Angeles, Calif., announces the appointment of John F. Curd as district manager of the Cincinnati, Ohio, office which has been moved to 2904 Woodburn Ave.

**American Wheelabrator & Equipment Corp.**, Mishawaka, Ind., has appointed Leroy J. Wieschaus as district manager of the Birmingham sales office.

**General Motors Corp.**, Detroit, Mich., has announced acquisition of all outstanding stock of The Euclid Road Machinery Co., Cleveland, Ohio,

# ERIE PORTABLE TRUCK MIXER PLANT BIG SUCCESS DOWN IN SAO PAULO, BOOMING CITY OF BRAZIL!

One man operates this Erie-Strayer Portable Concrete Mixing Plant. Set-up includes: 40 cu. yd. materials bin; 70-ton per hour bucket elevator for loading bin; 1-cu. yd. mixer and 1-cu. yd. bucket hoist for loading truck mixers with pre-mixed concrete. Sold by: Vias E. Viaturis, Sao Paulo, Brazil.

**ANTONIO MARQUES SOARES OF USINA CENTRAL De CONCRETO, S/A, SAO PAULO, SAYS: "THE ERIE-STRAYER PORTABLE IS EXTREMELY USEFUL AND VERY MUCH RECOMMENDED . . . PLAINLY SATISFIED"**

During the past five years, Sao Paulo's industrial, commercial and geographical expansion has made it the modern metropolis of South America.

Usina Central De Concreto S/A has an important part in the city's development supplying ready-mixed concrete for city buildings and street construction in general. Since October 1952, they have been using Erie equipment. This is their statement about it: "The Erie-Strayer Portable Concrete Plant, due to its well-thought aggregate and water weighing system, is extremely useful.

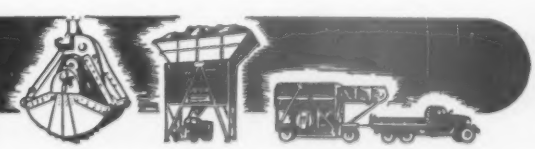
"It is very much recommended for the supply of concrete destined to huge operations which call for various types of rationally mixed concrete, and for consumption of a minimum of 100 cu. yd. per day.

"We are plainly satisfied with the performance of this fine machine."

In Buffalo, Sao Paulo, Tokyo or Berlin, Erie equipment gets a similar stamp of approval. Why? Because Erie equipment is engineered and built to deliver the utmost in satisfaction . . . under all conditions . . . anywhere.

*For further information, write to* Dept. P123

**ERIE**
**STEEL CONSTRUCTION COMPANY**
**4123 GEIST ROAD • ERIE, PENNSYLVANIA**



# CUT MATERIAL HANDLING COST

Salem Type

Specify Super-Service

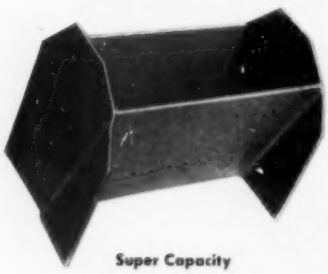
STANDARD

STEEL ELEVATOR BUCKETS

STANDARD Steel Buckets "stand up like champions" in resisting abrasion and corrosion.

Rigidly built of top-grade steel. Reinforcing strip may be welded to bucket lip, and hard surface rod added to insure extra service life.

High-economy STANDARD Buckets are available in all styles, types, sizes, and gauges. We are equipped to furnish new units or recondition present equipment at minimum cost.



Super Capacity

*Write Today. You will approve our Prices and our Service.*

STANDARD METAL MFG. CO.

110 CENTER ST., MALINTA, OHIO

# PYRASTEEL

**SEGMENTAL KILN ENDS FOR CEMENT PLANTS**

**. . proven satisfactory in THOUSANDS of Installations**

Avoid burnouts and shutdowns, and insure years of continuous service, by equipping your kilns, both feed and discharge ends, with PYRASTEEL Segmental Kiln Ends.

PYRASTEEL is equally effective and economical in many other high-heat applications, including clinker coolers, conveyor screws, feed pipes, and drag chains.

Over three-quarters of the annual cement output is produced in plants using either or both of our alloys, PYRASTEEL and EVANSTEEL.

**PYRASTEEL KILN END,** Discharge end

Unit Segments are easy to install or replace

Write for PYRASTEEL Bulletin

**CHICAGO STEEL FOUNDRY CO.**

Kedzie Avenue and 37th Street • Chicago 32, Illinois

*Makers of Alloy Steel for Over 40 Years*


which will be operated as a wholly owned subsidiary. Present management will continue under direction of Raymond Q. Armington, president and general manager.

**Barber-Greene Co.**, Aurora, Ill., has announced the appointment of Edward J. Curtin as sales manager of the northeastern sales area, which comprises all of New England, New York State and part of New Jersey. He succeeds Earle F. Lamprey, who will supervise export activities in the New York office.

**H. K. Porter Co., Inc.**, Pittsburgh, Penn., has announced the appointment of G. N. Dow as Chicago district sales manager of the Leschen wire rope division. The Chicago district includes northern Illinois, Iowa, Wisconsin, northern Indiana, Michigan and Minnesota.

**Galion Allsteel Body Co.**, Galion, Ohio, announces that Robert R. Sheffer has been appointed regional sales manager in the Ohio, West Virginia, Michigan, western Pennsylvania and western New York territory. He was formerly sales representative for the Marion Metal Products Co.

**Olin Industries, Inc.**, East Alton, Ill., announces the appointment of John L. Miller as special sales representative for the Columbia Powder Co., a subsidiary, in Montana, North and South Dakota and Wyoming.

**Hudson Pulp & Paper Corp.**, New York, N.Y., announces that Charles Grondona, vice-president, has resigned. He has been supervising design and construction of the American Israeli paper mill in conjunction with the Merritt-Chapman, Scott Corp.

**The Timken Roller Bearing Co.**, Canton, Ohio, has announced the retirement of George W. Curtis, Milwaukee division sales manager, after 33 years of service. Mr. Curtis plans to live in Fort Myers, Fla., where he has formed a new company, Curtcraft Inc.

**Leebaw Mfg. Co.**, Youngstown, Ohio, has announced the appointment of James Schwarz as sales manager. He was formerly vice-president and sales manager of the Y & Y Distributing Co.

**Dravo Corp.**, Pittsburgh, Penn., has appointed Garland C. Raines as manager of publications. He was formerly publicity supervisor for the small motor division of Westinghouse Electric Corp., Lima, Ohio.

**Chase Bag Co.**, Chicago, Ill., has announced the appointment of James F. Pouchot as sales representative, who will be assigned to the Chicago office after completing routine field training.

**Lincoln Electric Co.**, Cleveland, Ohio, announces that A. F. Davis, vice-president and secretary, has been made an Honorary Farmer in the Fu-

## GARDNER-DENVER CONGRATULATES

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

**on the speedy progress in the construction of the Sir Adam Beck Generator Station at Niagara Falls, Ontario, and the men of Rayner-Atlas Construction, Ltd., on their choice of methods and equipment which make this record advance possible.**

SCORE BOARD FOR THE WEEK OF JUNE 19 - JUNE 26 RAYNER - ATLAS SHAFT NO. 2

| | N. Heading | S. Heading | Total |
|---|---|---|---|
| Total Advance of Headings | 276' | 292' | 568' |
| Number of Rounds Blasted | 16 | 17 | 33 |
| Advance per Round | 17.2' | 17.2' | 17.2' Av. |
| Number of Shifts | 21 | 21 | 42 |
| Advance per Shift | 13.1' | 13.9' | 13.5' Av. |
| Cu. Yds. Excavated per Week | 12,972 | 13,724 | 26,696 |
| Drills | 22 G.D. Model D93 | 22 G.D. Model D93 | 44 G.D. Model D93 |

SINCE 1859

**Only Gardner-Denver Drills were used in the world's record week and not one drill missed a shift!**

# GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Company (Canada) Ltd., 14 Curity Ave., Toronto 13, Ontario

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS
FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

# STEEL

***Prompt Delivery from Stock***

**Plates, Structurals, Bars, Sheets, Tubes, etc. Carbon, Alloy, Stainless Steels, Babbitt Metal.**

# RYERSON

**Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco, Seattle, Spokane**


ture Farmers of America. The James F. Lincoln Arc Welding Foundation, of which Mr. Davis is secretary and whose activities he has guided since 1936, is active among farm high school students all over the United States.

**Republic Rubber Div.,** Lee Rubber & Tire Corp., Youngstown, Ohio, announces the retirement of Ralph M. Gattshall, district manager in Atlanta, Ga., after 31 years of service. He joined the company in 1922 as zone manager in Kansas City.

**Olin Industries, Inc.,** East Alton, Ill., has appointed Frank A. Peschl as director of engineering. He was formerly in charge of engineering of the Ecusta Paper Corp., a subsidiary at Pisgah Forest, N. C.

**Bemis Bro. Bag Co.,** St. Louis, Mo., announces construction of a new manufacturing plant in Wilmington, Calif., for production of multiwall paper shipping sacks. Plant will be made of concrete tilt-wall construction.

**American Tractor Corp.,** Churubusco, Ind., has announced the appointment of D. A. Milligan as vice-president in charge of sales. He was formerly sales manager of Harry Ferguson, Inc.

**Sterling Engine Co.,** Buffalo, N.Y., has announced that Curtis S. Smiley, Rear Admiral, U.S.N. (Ret.) has been appointed to the executive committee as assistant to Robert Russell, president, and that W. A. MacDonald, vice-president of sales, has been named executive vice-president.

**Arkell & Smiths,** Canajoharie, N.Y., manufacturers of paper bags, has announced completion of its expansion program at the Wellsburg, W. Va., plant.

**Richmond Screw Anchor Co., Inc.,** Brooklyn, N.Y., manufacturers of tying devices for concrete construction, announces completion of its new branch factory in St. Joseph, Mo.

**General Electric Co.,** Plainville, Conn., announces that H. S. Farmilo has been named manager of the Philadelphia sales district of the distribution assemblies department, which includes Metropolitan Philadelphia, Harrisburg, York, Lancaster, Allentown, Scranton, Williamsport and Reading, also Trenton and southern New Jersey.

**Kensington Steel Co.,** Chicago, Ill., announces the appointment of Walter L. Vaughan as sales engineer in the Michigan-Indiana-southern Wisconsin territory.

**Harbison-Walker Refractories Co.,** Pittsburgh, Penn., announces the appointment of Leo L. Gill as manager of the technical sales department.

**United States Rubber Co.,** New York, N.Y., has announced the appointment of Kent A. Blakeslee as assistant to Warren A. Tipton, general sales manager, mechanical goods division.

**The Baker Mfg. Co.,** Springfield, Ill., announces plans for construction of a new manufacturing plant in Beardstown, Ill.

**Westinghouse Electric Corp.,** Pittsburgh, Penn., announces that the two-year expansion and improvement program at the mica plant at Irwin, Penn., is nearing completion.

**Hammond Bag & Paper Co.,** Wellsburg, W. Va., announces that its new plant at Charlotte, N. C., is now in full production. R. C. Barnes is manager and Carl Metcalf is superintendent of the plant.

**Robertshaw-Fulton Controls Co.,** Philadelphia, Penn., has announced the appointment of R. M. Stotsenburg as sales manager of the Fielden instrument division.

**Clark Equipment Co.,** Buchanan, Mich., announces the appointment of Clarence E. Killebrew as manager for marketing and sales for the construction machinery division. He was formerly general sales manager for The Frank G. Hough Co.

**H. K. Porter Co., Inc.,** Pittsburgh, Penn., announces establishment of a new sales district in Houston, Texas, for the Leschen wire rope division, covering Texas, Louisiana and Oklahoma. F. E. Suder is manager of the district office.


# MODERNIZE YOUR PLANT with Cedarapids-Schrock MOTORIZED HEAD PULLEYS

Here's a plant *modernized* with Motorized Head Pulleys that cut conveyor downtime up to 90% because all moving parts are inside the pulley shell! You save labor, too. On the installation shown at the left, the control switch enables the truck driver to pull up and load his own truck simply by pressing the button.

**HUNDREDS OF INDUSTRIES ARE REDUCING CONVEYOR DOWNTIME 70% to 90%**

• NOW you can eliminate maintenance headaches on your belt or belt-bucket conveyor installations. With Cedarapids-Schrock Motorized Head Pulleys there are no chains, sprockets, sheaves out in the weather and dirt, no chain idlers to keep adjusted and oiled, no V-belts to adjust or replace, no shafts and drives to service or lubricate. *There is no other pulley like it!*

The next time you're down for weather, between jobs, or shut down for any reason, provide for future cuts in maintenance costs by modernizing your plant with *Motorized* Head Pulleys. Your Cedarapids distributor can give you the money-saving details.

**Built for sale in Arizona, California, Nevada, New Mexico, Southern Oregon, Southwestern Utah and Texas by**

**YUBA MANUFACTURING CO.** (Pulley and Sprocket Dept.) **Benicia, California**

**IOWA MANUFACTURING COMPANY,** Cedar Rapids, Iowa, U.S.A.

# Meet and Beat Competition

with

MM MODERN MACHINERY **WHEELER** *Capacity*

MM MODERN MACHINERY **WHEELER** *Speed!*

Here's the 51 hp MM UTIL WHEELER feeding aggregate into asphalt mixing plant. Owner says UTIL shuttle gear lets him double his loading speed.

Streamline loading, stockpiling, clean-up jobs . . . move large loads over rough, unpaved yards at high speed! Handle all load shapes and sizes in less time with easy-steering, heavy-duty MM Wheelers. On every job, MM Wheelers are *money-makers*. They're lower in first cost because MM high-production cuts manufacturing costs. Extra speed and capacity hold down operating costs, help you show a *better* profit job-after-job.

If you're checking your expenses closer these days, *compare* MM Wheelers against the field. Check for *power, speed, capacity, price*. Try the Wheelers for performance and ease of operation. See for yourself why more and more companies call MM Wheelers the *leaders* in industrial loader value.

MM maneuverability lets Wheelers work in tightest spots. Handling ease cuts operator fatigue, boosts operator efficiency.

**MINNEAPOLIS-MOLINE** MINNEAPOLIS 1, MINNESOTA

# How LINK-BELT Welded Steel Pulleys minimize shaft deflection

LINK-BELT Welded Steel Pulleys end one common cause of head and tail shaft failure by minimizing deflection. By making the hub flush with the pulley face, bending moment is directly decreased. In addition, Link-Belt design assures minimum disc deflection . . . reduces hub bolt stress. With water- and dust-tight construction — plus provision for interchangeable hubs — you get lower maintenance, top performance and longer pulley life. Ask your Link-Belt representative for full details.

Note how the bearing support and hub of the Link-Belt Welded Steel Pulley are mounted with minimum clearance.

**LINK-BELT**

**WELDED STEEL PULLEYS**

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices, Factory Branch Stores and Distributors in Principal Cities.

19,215

# WELLMAN *Williams Type*

## PERFORATED DRAGLINE BUCKET

### *speeds the wet jobs*

● You get big loads fast with this Wellman Perforated Dragline Bucket because excess water goes out while gravel stays in on jobs such as illustrated.

Built of special alloy steel—all welded for strength plus light weight. You can work faster with less maintenance with Wellman dragline buckets.

***Want Facts?***

*Write for free descriptive bulletins.*

Dragline, Clamshell, Custom-Built Buckets, Stone and Wood Grabs.

**THE WELLMAN ENGINEERING COMPANY**

7000 Central Avenue • Cleveland 4, Ohio

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# S-A

for handling
**ROCK PRODUCTS**
at **ROCK-BOTTOM COST**

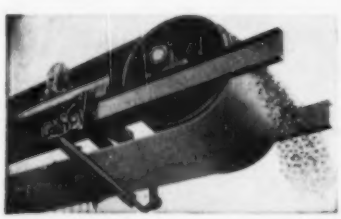
for EXAMPLE...

**"TWISTITE" BIN VALVES**

For dust-tight, dribble-proof bin flow control of both lump and fine materials. Rubber sleeves twist for a tight seal, by means of either hand or motor control, local or remote. When gate is open the two rubber sections, joined by a rotating collar, allow free flow. Write for Bulletin 254-A.

**S-A BELT CONVEYORS**

Engineered and built to withstand heavy duty service in moving large volumes of materials at low cost per ton. Available in a wide variety of sizes and arrangements—to meet specific operating conditions. Ask an S-A engineer for full details, or write for Catalog 146.



**CONVEYOR BELT CLEANER**

Pays for itself by prolonging belt life. Removes wet or dry material, leaving surface of belt clean and dry. Installs easily on any belt conveyor. No moving parts—no power is required. Write for Bulletin 651.

**STEPHEN S·A DAMSON MFG. CO.**

7 Ridgeway Avenue, Aurora, Illinois • Los Angeles, Calif., Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

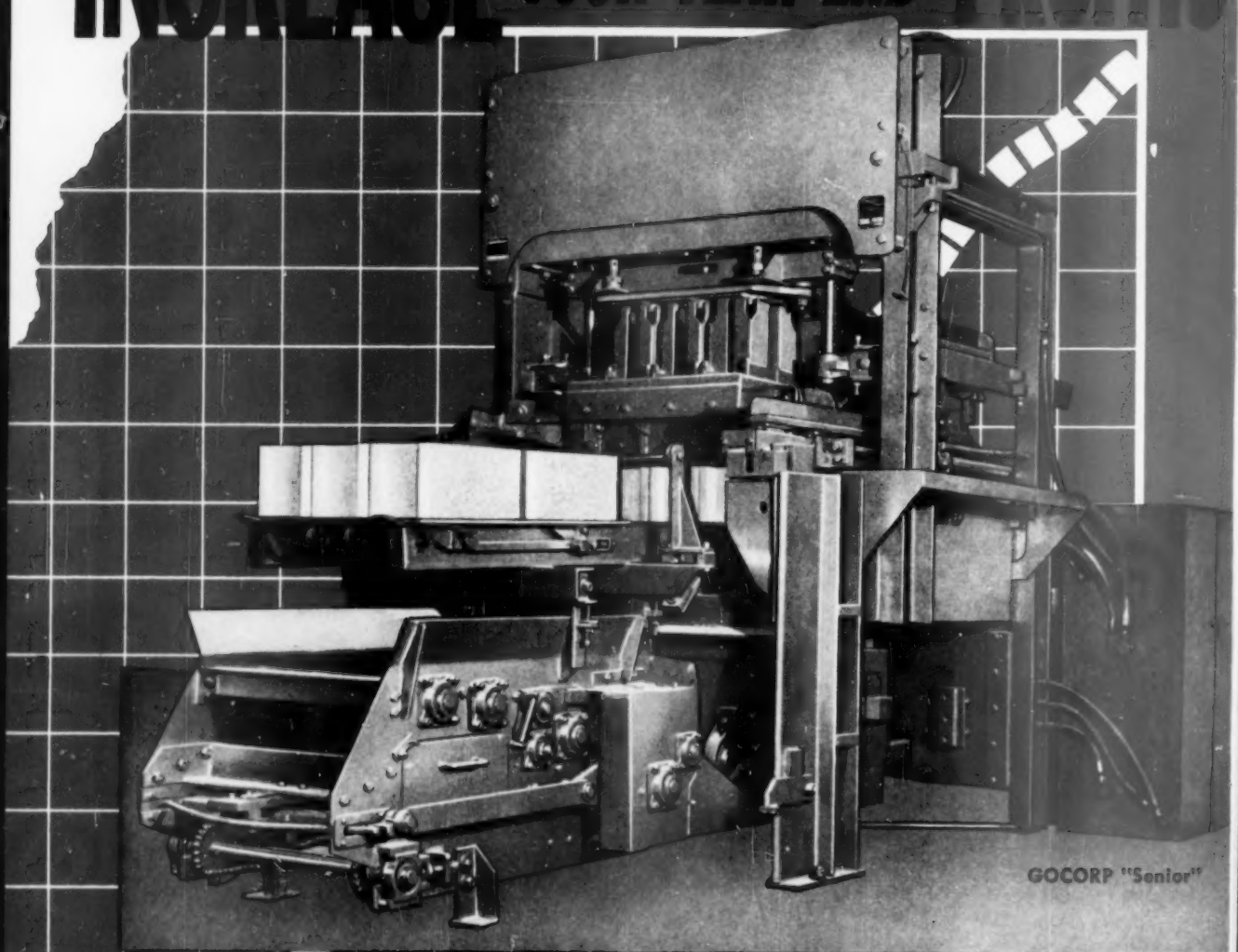
# CONCRETE PRODUCTS

A SECTION OF ROCK PRODUCTS

CONCRETE UNITS . READY-MIXED CONCRETE

Sand blasting block provides attractive surface textures and color tones

# INCREASE YOUR YEAR END PROFITS



GOCORP "Senior"

## with a GOCORP

Because GOCORP Plain Pallet Machines (The King—6 at a time or the Senior—3 at a time, illustrated) mean ✓ a quality product that helps you get [illegible] and repeat orders ✓ quantity production for lower *unit* production costs ✓ reduced maintenance and uninterrupted production allowing you to keep the profits you've made.

**AND with a GOCORP there's no fear of obsolescence.**

***For complete information on plain pallet machines, batch mixers (12 to 75 cubic foot capacity), pipe and tile machines, or junior cored pallet block machines write or phone today.***

### HERE'S HOW GOCORP DOES IT—

- **Direct Feed** from main supply hopper to mold (no old fashioned feed drawer) plus intense vertical vibration (pallet clamped to mold) assures a *uniformly* dense unit.
- **Sequence Operation** for easy adjustment and greater production. Under Machine Pallet Return—saves space and reduces labor costs with one man operation.
- **Hydraulic Drive**—Smooth trouble-free performance—reduces maintenance. GOCORP'S Johnny-on-the-spot factory trained men for help when you need it.
- **Advanced Design** gives you "Tomorrow's machine today."

GOCORP
ADRIAN-MICH.

407 Gross Street Adrian, Michigan

# INDUSTRY NEWS

## Plant Expansion

AGGREGATE PROCESSORS, INC., White Pigeon, Mich., formerly known as White Pigeon Sand & Gravel and White Pigeon Ready-Mix Co., is expanding its present operations by the establishment of a ready-mixed concrete batching plant at Three Rivers, Mich., approximately 14 miles from the main plant. Plans are also underway for the establishment of additional small batching plants at other nearby locations now served by the main plant, for the purpose of reducing mileage hauls and to provide better service to the customers.

In addition to ready-mixed concrete, the company produces mason and concrete sands, pea gravel, ¾-in. stone, and 5L and 6A stone.

Owners of the company are Gloria J. Brown, president and treasurer; Don R. Aldrich, vice-president; and Ben A. Jensen, secretary. The three present owners were all formerly employed in the previous company, then owned by C. R. and Eric H. Joelson, who now own and operate the Venice (Florida) Redi-Mix Co.

## Cover Picture

ON THIS MONTH'S COVER of Concrete Products is an illustration showing how MacIsaac and Menke Co., contractors of Los Angeles, Calif., sand blasted concrete block to give new surface textures and color tones to walls. The method was discovered during construction work at the Maywood, Calif., plant of Consolidated-Western Steel Co., division of U.S. Steel Corporation.

## Pavement Yardage

AWARDS OF CONCRETE PAVEMENT for the month of October and for the first ten months of 1953 are listed by the Portland Cement Association as follows:

| | Sq. yd. awarded | |
|---|---|---|
| | During October 1953 | During first ten months 1953 |
| Roads | 3,690,943 | 36,246,333 |
| Streets and alleys | 1,581,780 | 22,767,285 |
| Airports | 821,518 | 9,691,909 |
| Totals | 6,094,241 | 68,705,527 |

## Ancient Concrete Samples

HENRY L. KENNEDY, president of the American Concrete Institute, recently brought samples of 2000-year old concrete to the United States, which was recovered from an ancient submerged Roman wharf. The samples, believed to be the oldest known example of hydraulic concrete, were taken from piers which once supported a large wharf in the bay of Pozzuali, Italy, near Mt. Vesuvius. Prior to the discovery, it was thought that the ancients, who normally built such structures of masonry, had not learned how to make hydraulic concrete. According to Italian concrete technologists, who presented the samples to Mr. Kennedy, Roman engineers discovered that the volcanic ash from Mt. Vesuvius reacted with lime to make a cement which would harden under water.

The concrete samples are being tested in the Dewey and Almy laboratories at Cambridge, Mass., to determine their resistance to weathering, freezing-thawing action and other deteriorating forces.

**Henry L. Kennedy examines samples of 2000-year-old concrete, still in serviceable condition, which were recovered from an ancient submerged Roman wharf**

## Concrete Plant Permit

A COMMON PLEAS JUDGE recently ordered the Solon, Ohio, Council to grant a permit to Goff-Kirby Co. for building a $2,000,000 concrete plant in the suburb. The Solon Council had earlier approved a 35-acre tract for industrial use, but revoked its approval following protests from local residents, who alleged the proposed plant would create too much dust, noise, offensive odors, and vibrations. Goff-Kirby Co., which had already partially paid for the property, took the case to court where county health and engineering experts testified that the plant would not be detrimental to the health of the residents.

## Concrete Batch Plant

MADISON SAND AND GRAVEL CO., Winters, Calif., was issued a permit to build and operate a concrete batch plant adjacent to a proposed subdivision. The owners of the proposed subdivision felt that the plant would not interfere as the subdivision plans may be changed.

•

JEWELL CONCRETE PRODUCTS, Waco, Texas, has started operation of its new plant two miles from Waco on Highway 84. Its former plant was destroyed by a tornado.

BRICKOTE CORP. OF AMERICA, St. Louis, Mo., has been recently organized to take over national operation of the "Brickote" patented masonry process, formerly owned by National Brickote Co. Officers of the new company include Leo J. Lewis, president; Albert Sandrow, vice-president and general manager; and R. H. Williams, vice-president.

GUY MILLER and Joy Miller, Beloit, Wis., recently purchased a ready-mixed concrete and concrete block plant from Vail and Maurice McDonald. The plant, formerly known as the Beloit Block Plant, will operate as Beloit Concrete Products Co., with facilities for a daily production of 2000 block.

DODSON MANUFACTURING CO., Dodson, Kan., owned by Leon and Glen Dodson, has announced plans to expand its Cherryvale, Kan., silo plant, purchased about a year ago from Interlocking Stave Silo Co. Plans call for the addition of two steam kilns, plus expansion of the raw materials storage capacity.

WESTERN CONCRETE, INC., Denver, Colo., has been incorporated by Frederick D. Hoppe, P. F. DeTamble, and Louise D. Hoppe, who will also constitute the board of directors. In addition to concrete, the firm will also deal in sand and gravel and other building materials.

PRODUCERS' COUNCIL, INC., Seattle, Wash., Chapter, recently held a meeting for a showing of the film "Construction of Watertight Masonry Walls." Members of the American Institute of Architects were guests at the meeting.

NORTH DAKOTA CONCRETE PRODUCTS CO. is building a concrete products plant at Williston, N. D., to replace its old one. The new plant will include heating facilities to insure year-round operation.

CINDER CONCRETE PRODUCTS, INC., Denver, Colo., has awarded a $500 scholarship to a senior civil engineering and business student at the University of Colorado.

THE MOAB SAND AND GRAVEL CO., Moab, Utah, has started ready-mixed concrete operations at its quarry, utilizing a 2-cu. yd. transit-mixer truck.

THE PORTER-DEWITT CO. has begun operations at its recently completed ready-mixed concrete plant at Poplar Bluff, Mo.

SEATTLE CONCRETE PIPE CO., Seattle, Wash., has leased two sheds to house operations for the production of concrete slabs.

ORRIS R. HANSEN has opened a concrete block plant near Boone, Wash.

1,000 BLOCK PER HOUR (8" EQUIVALENT)

1,000 BLOCK PER HOUR (8" EQUIVALENT)

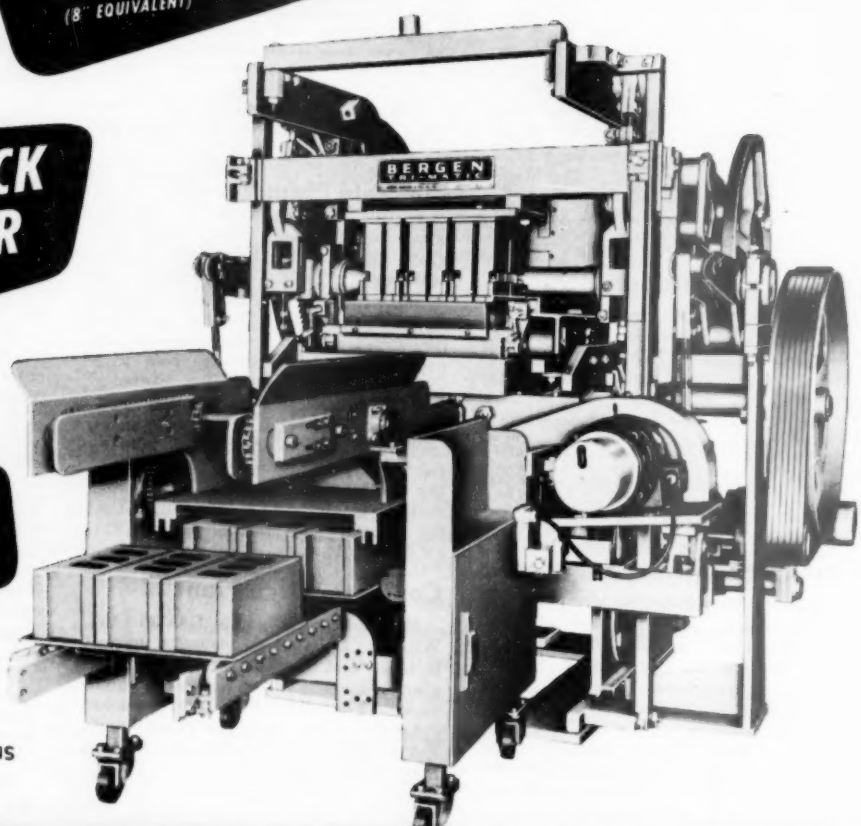
1,000 BLOCK PER HOUR (8" EQUIVALENT)

BERGEN TRI-MATIC

1,000 BLOCK PER HOUR (8" EQUIVALENT)

1,000 BLOCK PER HOUR (8" EQUIVALENT)

1,000 BLOCK PER HOUR (8" EQUIVALENT)



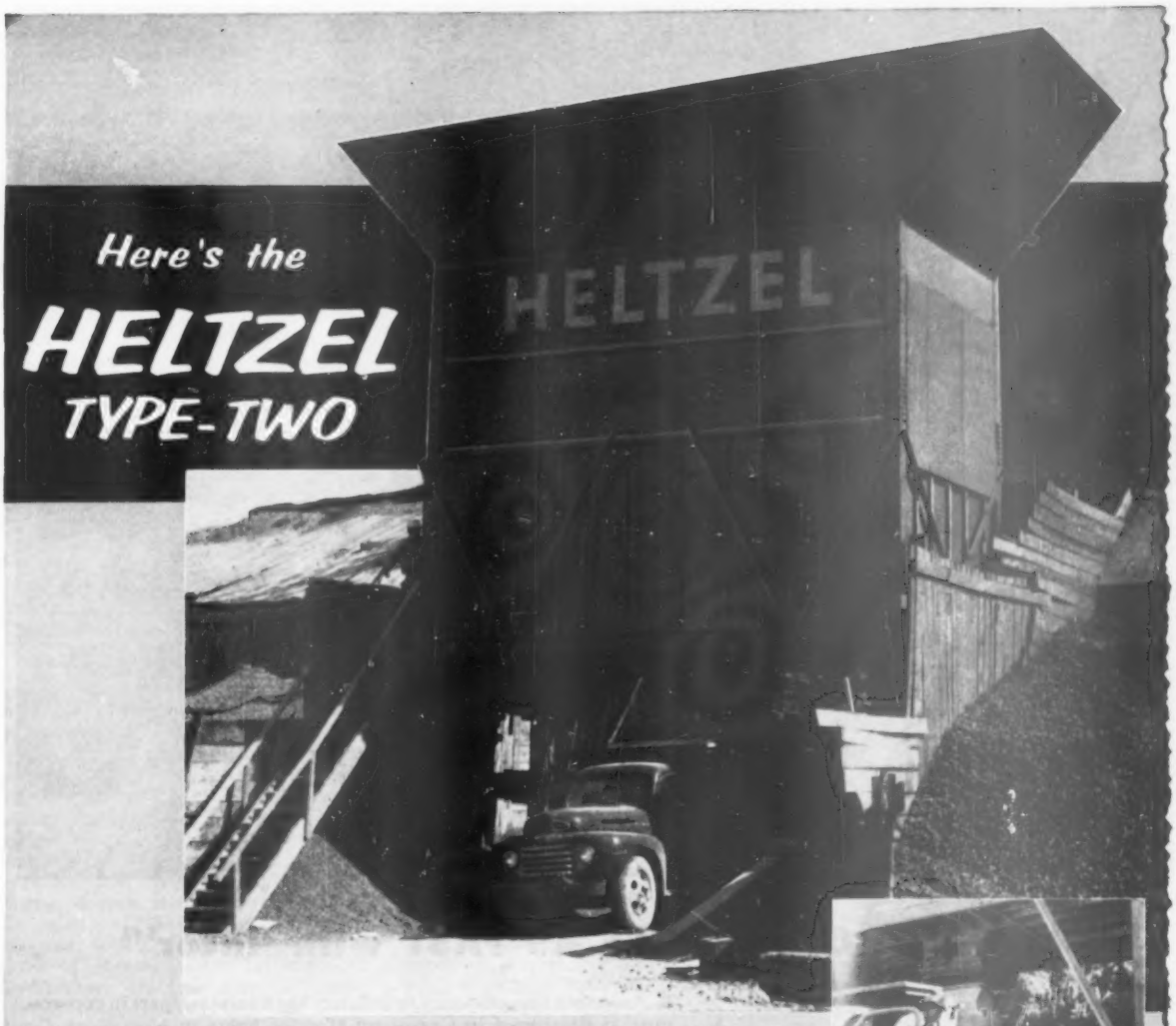

AVAILABLE 3 WAYS
- ON LEASE BASIS
- LEASE with OPTION TO BUY
- OUTRIGHT SALE

APPROX. SHIPPING WT. 14 TONS
(WITHOUT FRONT PALLET RETURN)

BERGEN MACHINE & TOOL CO., INC. 189 FRANKLIN AVENUE NUTLEY, NEW JERSEY

Here's the

# HELTZEL TYPE-TWO

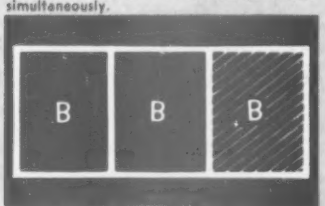



## The *LAST WORD* in Fast-Acting Portable Bins

Here's the last word in portable batching plant design . . . the New Heltzel "Type Two" fast-working aggregate or aggregate-cement batcher that has whisked through its initial on-the-job tests with colors flying. Capacities 150 and 200 Tons. Precise, fast, accurate and versatile, the "Type Two" can be erected or dismantled in a few hours. Easily carried over the road, and well within highway limitations. Variety in bin compartmentation arrangements, makes possible blending for almost any combination mix. Cement included on Ready Mix operation. Dual batcher loads two truck compartments simultaneously on paving setup.

Automatic electronic batching equipment easily adapted to the plant, permits batching of 250-yards-per-hour with less than 1 25th of 1 percent error. And all this with simple push button operation. Before you purchase new batching equipment, see your Heltzel representative or write the factory direct about this amazing new high speed, portable "Type Two" bin and batch plant.

Dual Batcher loads two truck compartments simultaneously.




One of a wide variety in bin compartmentation arrangements that make possible the blending of almost any combination mix.

**Available in Fully Automatic Electronically Controlled Series . . . . .**

## Another New Installation

**THE HELTZEL STEEL FORM & IRON CO.** **WARREN, OHIO**

# "The Job Goes TWICE AS FAST with 'Incor'"

**GRAVESEND HOUSES**, Brooklyn, N. Y.

Owner: **NEW YORK CITY HOUSING AUTHORITY**

General Contractor:
**CAYE CONSTRUCTION CO., INC.**, Brooklyn, N. Y.

Architect: **MATTHEW W. DEL GAUDIO**, New York

Structural Engineers:
**TUCK & EIPEL**, New York

Ready-mix 'Incor' Concrete:
**COLONIAL SAND & STONE CO., INC.**, New York

● Assembly-line efficiency in industry has its counterpart in construction, as illustrated in Gravesend Houses, latest in New York City Housing Authority's record-shattering program.

Foundation problems slowed the job—but concreting know-how made up two months' lost time, got the job back on schedule. Walls and slabs above first floor, in the 15 seven-story units, were concreted with 'Incor' 24-Hour Cement.

Well-built forms were filled, stripped, reassembled, on schedules as precise as any automobile assembly line: 105 floors concreted in 66 working days—1.6 floors a day! Contractor's sum-up:

'Incor' was a life-saver . . . the job went twice as fast, thanks to high early strength you can rely on . . . exceptionally smooth surfaces saved on finishing, too.

Point to remember: Today's concreting methods, with an assist from 'Incor',* make available the inherent fire-safety of concrete-frame construction, at faster erection speeds—and lower costs.

*Reg. U. S. Pat. Off.

LONE STAR CEMENTS COVER
THE ENTIRE CONSTRUCTION FIELD

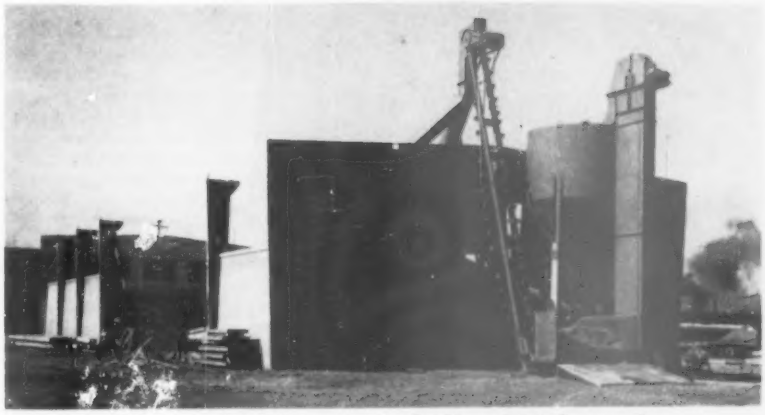
## LONE STAR CEMENT CORPORATION

Offices: ABILENE, TEX. • ALBANY, N. Y. • BETHLEHEM, PA. • BIRMINGHAM
BOSTON • CHICAGO • DALLAS • HOUSTON • INDIANAPOLIS
KANSAS CITY, MO. • NEW ORLEANS • NEW YORK • NORFOLK
PHILADELPHIA • RICHMOND • ST. LOUIS • WASHINGTON, D. C.

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS: 18 MODERN MILLS, 129,000,000 SACKS ANNUAL CAPACITY

**Concrete Engineering Co., Tacoma, Wash., operated by the Anderson brothers, has set up a unique plant for the mass production of heavy structural member with special equipment developed for prestressing the reinforcing steel**

By A. R. MAC PHERSON



Plant view taken during construction. Batching unit is in foreground

## Applying Mass Production to

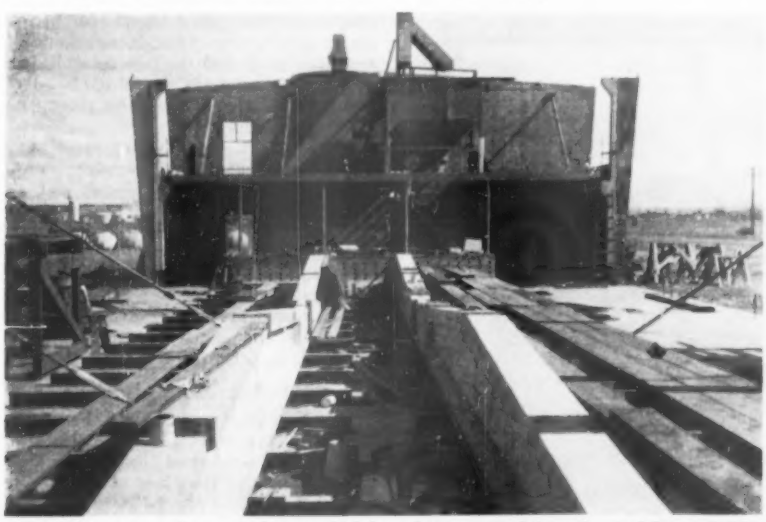
# Prestressed Structural Concrete

IN TACOMA, WASH., two engineer brothers, Art and Tom Anderson, are pioneering in the concrete industry's most rapidly growing development—prestressed concrete. Both young men have had a world of experience through study, observation and research in both the theoretical and practical phases of the subject.

Both men received bachelor of science degrees in engineering at the University of Washington and later received scholarships for graduate work at Massachusetts Institute of Technology. Moving then to Cambridge, they received their master's degree and worked for awhile on the teaching staff of M.I.T.

In 1938, the brothers were in Europe—Tom in Norway where he spent a year designing bridges for that government, while Art gained practical experience in Germany, working with a steel company building bridges for Hitler's famous Reichsautobahn—a fabulous network of modern highways.

During World War II Tom served in the Navy in the Pacific, rising to the rank of commander in a Seabee construction battalion. Following the war, Art opened his own engineering consultation office in Stamford, Conn., doing work as a concrete engineering specialist during which time he developed the "strainmeter," a machine for measuring stresses in structures and machinery.



Two 100-ft. prestressed concrete beams which have been removed from the steel forms. A 6-in. space at the center permits cutting of the reinforcement rods to form two 50-ft. beams. Note concrete bulkhead at far end and batching scale hopper, above

As revealed in a former article in these columns, he also invented the Consphere, a home oil storage concrete tank which was also manufactured and marketed in Tacoma by brother Art.

Both men became interested in the possibilities apparent in the prestressed concrete industry, making a tour of European plants before coming home to organize and build their own Concrete Engineering Co. in Tacoma.

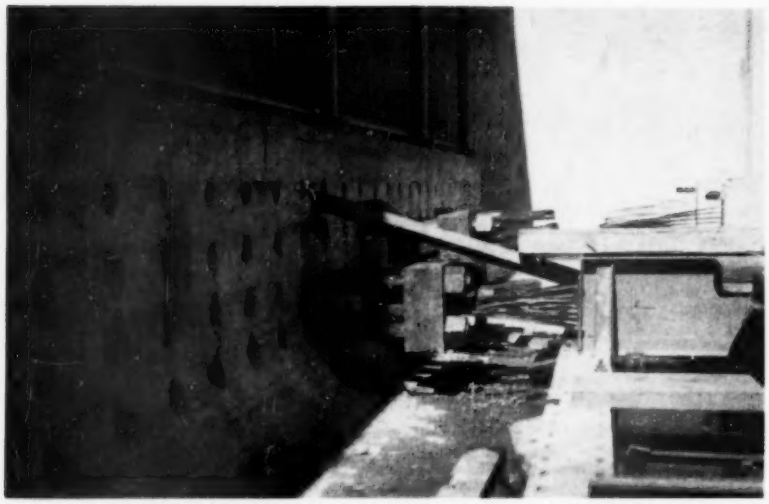
They found that France had pioneered in prestressing of concrete with Germany a close second in research and achievements prior to outbreak of World War II. The new construction method had become well established throughout Europe before coming into acceptance and usage in this country.

Art served as a consultant on the construction of one of the world's largest prestressed concrete bridges which spans a deep canyon outside Caracas, Venezuela.

### Prestressed Concrete Plant

The latest adventure of the brothers is the building of a new plant located in the tideflats industrial area of Tacoma, specializing in the manufacture of prestressed concrete products such as frames of all types, structural beams and members, and all manner of concrete supports and materials to be used in building transmission towers, bridges, barges, drydocks, industrial buildings and even homes.

The new project consists of a pilot plant, 45 x 140 ft., an adjoining shop 30 x 60 ft., and a small office building. The new plant literally built itself. The concrete floor was poured first and all machinery and necessary



Front view of bulkhead showing prestressed reinforcement steel rods, leading out of concrete forms, which are drawn into conical form and secured behind steel block held by four tension bolts and nuts

Behind the bulkhead may be seen the four heavy, threaded steel bolts used to apply tension to the wires. Hydraulic rams may be seen between the tension rods with air line hose leading to the pumps

Interior view of plant with prestressed concrete roof beams recently installed. Note steel ties on floor to support steel forms for the manufacture of prestressed concrete structural members. One form, down the center, already has been poured

equipment then installed for making prestressed concrete in an open-air set-up. Ordinarily, a relatively small plant of this type could be constructed in a month or so. However, the brothers spent many long months experimenting with different methods and formulas for making prestressed concrete. Walls of the pilot plant were constructed with prefabricated concrete slabs which were erected by the up-tilt method. Window frames, roof beams and other structural members were made of prestressed concrete, using their new equipment and carefully evolved formulas.

The cement companies offered them help and advice gained in company research, and also available was information gained from several university researches on prestressed concrete which have been under way recently. However, the brothers chose the longer and more difficult way of working out their own methods and formulas.

An assembled batching unit was installed at one end of the plant. Link-Belt bucket conveyors carry sand and gravel aggregates from bins at ground level to the roof of the plant where chutes direct the materials into a Fairbanks, Morse scale tank installed on a balcony. After adding carefully weighed water and cement, the batch drops into a 1-cu. yd. Tornborg-Lundberg Swedish electric mixer installed just below the balcony floor. After mixing, the wet batch moves by chute into two-wheeled concrete buggies, and is conveyed to the steel forms for pouring.

## Research Studies

In conducting research on prestressed concrete, the brothers constantly varied and checked their formulas and methods, carefully measuring the ratios of cement, sand, gravel and water and recording all experiments. Small miniature steel boxes were employed for testing batches on an Olson electric tester block installed in a small laboratory. This latest testing machine subjected the concrete blocks to compression tests up to 400,000 lb. to accurately determine the strength of the concrete.

Obviously, a 5-gal. water ratio per sack of cement makes stronger concrete than the normal 7-gal. ratio. The brothers carried on many experiments using a 4-gal. ratio. Since such a batch will barely flow and causes difficult handling problems, an elaborate system of mechanical vibrators of their own invention were employed to make the dense concrete settle properly in the forms.

## Manufacturing Methods

Prestressed structural members are made in long steel forms resting on 42 evenly spaced steel ties laid on the concrete floor of the plant. At each end of the forms, and spaced 100 ft. apart, is a massive concrete bulkhead, 25 in. thick at the floor base, 28 ft. long and 3 ft. high. Each bulkhead is perfor-

ated with 100 holes running entirely through each wall, evenly spaced with 25 vertical and four horizontal rows of holes, each 2½ in. in diameter.

The holes are for the purpose of holding each set of four 9-ft. long, threaded steel bolts employed to stretch the wires passing through each steel form in which the concrete is poured. Steel plates bolted against the outside of each bulkhead hold the 2¼-in. bolts securely, once the tension has been built up on the wires. The holes in the bulkheads permit making several prestressed concrete products at the same time and at whatever height and size required.

The lengths of ⅛-in. high-carbon steel wires, which may be up to 40 in number, are drawn into a conical form at either front side of the bulkheads and securely held by zinc poured into a steel cylinder which in turn is centered securely in the back of a steel block bolted at the ends of each set of four bolts.

Two Rogers hydraulic rams are installed behind the bulkhead and secured evenly between each set of two bolts by means of a steel block so that the tension built up in the ram by compressed air is transferred to the four bolts, pulling them slowly backwards by the rising pressure of the ram head pressing against the bulkhead. Thus the wires running through the forms are stretched at a constantly increasing tension until the stress may reach as high as 200,000 p.s.i. or 100 tons. The tension is then maintained by tightening the nuts on the threaded bolts against the back of the bulkhead. Wet concrete batches are then forced into the steel forms, vibrated to settle evenly and tension maintained on the wires until the concrete is set. Tension is applied at only one of the bulkheads, and the tension is measured from time to time by a strain-meter applied at small slots left in the forms.

Two overhead traveling cranes were installed to hoist heavy concrete beams and other products, and to load them onto long flatbed trucks which can back directly into the plant.

The Andersons made a thorough comparative weight study of the possible steel savings obtained from the use of prestressed concrete. They found that 6200 lb. of steel are used in an average 50-ft. steel roof beam. The same beam made of standard reinforced concrete would require 2000 lb. of steel reinforcement. A 50-ft. roof beam made of prestressed concrete, on the other hand, would require only 450 lb. of high carbon steel.

Would there be any loss in strength in the effort to save steel? Lengthy research and tests made in European countries have determined that structural members made of prestressed concrete actually possess amazing strength. In Sweden they saw 100-ft. pilings, 8 in. square, withstand the weight of 30 tons.

While serving as a bridge consultant for the City of Philadelphia, it was found in an actual test that a 160-ft. prestressed I-beam girder would bend 27 in. at the ends before breaking.

The new plant is now completed and in full operation, turning out prestressed concrete products for contractors and various building projects. However, research work is being continued, and experiments are now being conducted with beams made of concrete block and prestressed concrete. Concrete block, of four interspace-type, are assembled between the two bulkheads with steel wires stretched through each interspace. Wet concrete is then forced into the interspaces and each tile block grouted together to form one long beam. Such beams are much lighter in weight than all-concrete girders and have withstood pressure tests up to 12,000 lb. Such light beams are already being used for small building construction, particularly in California.

When prestressed concrete has become the generally accepted building product which the Andersons confidently expect, the brothers will build a large, new plant in Tacoma on property already purchased. It will be complete with a dock to provide ocean-going shipping facilities to supply a much broader market for their products.

# Michigan Drain Tile Meeting

THE MICHIGAN DRAIN TILE ASSOCIATION held an informal meeting and equipment demonstration, November 3, at the Concrete Equipment Co. plant at Holland, Mich.

The group was conducted on a tour of the plant including the laboratory where representative tile samples submitted by the members of the association were tested. In the demonstration building, the new "Automatic" drain tile machine, manufactured by the W. E. Dunn Manufacturing Co., was put in operation to show its greater capacity over that of the old type machine. The new machine has an increased production of approximately 2500 tile per 8-hr. day. The size range will include up to 16-in. diameter tile; all 12 in. long. In the size range up to and including the 8-in. tile, three units are manufactured at the same time. This process is made possible by a rotating table which facilitates the removal of the filled casings, and places the empty casing in the refill position. Therefore, while the casing for one tile is being filled, a second tile is being formed and the third is in the process of removal. Other features include gears and working parts contained in the base of the machine and all worm gears operating in a continuous oil bath. Also inspected during the tour were the Dunbeam joist machine, the Cavitex and Dunbrik units, and the mixing and hoisting equipment.

Professor Cutler in answer to the query, what percent of tile now being used in Michigan was of concrete, said he believed it to be only about 50 percent. He added that all clay tile was either shale or surface clay and that to the best of his knowledge, there was no fired clay tile manufactured in Michigan.

A survey, he stated, showed that there were seven clay tile manufacturers and 60 cement tile manufacturers in the state at present. Clay tile manufacture, he added is held to a large operation and of necessity at the source of material, i.e., the clay deposit, whereas the cement tile operator can start on a smaller scale in almost any locale, materials being no problem.

Professor Cutler concluded his report with the information on a test the college was conducting on stability and efficiency of cement tile. The tile selected for this test were from four sources with the thought in mind, to make a comprehensive survey of the efficiency of each type.

The four types of tile being tested were water-cured, air-cured, steam-cured and in sections 24 in. long. In June and July of 1952, these tile were placed in an organic type soil for observation. There is no data available as yet because the organic material has not decomposed, this action being necessary to enable meas-

*(Continued on page 190)*

**Dinner meeting of Michigan Drain Tile Manufacturers Association**

A central mix plant in the Southwest. Note the interesting hood and chute arrangement

## 15. A producer views the ready-mixed concrete business . . .

# Transit vs. Central Mix

By JAS. A. NICHOLSON*

AS SUGGESTED BY HENRY FORD'S ADVICE† in the 1941 Manual, the job of the ready-mixed concrete man is to deliver, at lowest cost, the maximum amount of quality concrete with a minimum investment in plant and delivery equipment.

Undoubtedly the largest single factor in the phenomenal growth of the ready-mixed concrete industry was the development of the truck mixer in the late 20's. Today 70 percent of the approximately 1700 members of the industry use this unit to mix concrete in transit. On the basis of popularity with ready-mixed concrete producers, the revolving, high-discharge truck mixer is unquestionably the preferred method of processing concrete.

There is much to be said for a transit mix operation. Unquestionably many of those so operating think that this method is the best one. On the other hand, in recent years, a large number of transit-mix producers have gone to central mixing. Both methods have their advocates.

There is no such thing as a one best way in business. The business of processing and delivering ready-mixed concrete is no exception. Procedures that work fine for some producers, might not pan out at all for other operators. Indeed, under certain conditions, the changing over by a transit-mix producer, to a central mixing installation might be a foolhardy move. Intelligent, alert operators discount the abnormally high profit results of the past 10 years and carefully study their overall picture to determine the type of operation which best answers the problems of their local markets. For a dangerously long time, profits have continued to roll in. Too many operators haven't been particularly interested in seeking simpler, less expensive, possibly more effective means of achieving as good or better results. These operators apparently forget that their careers in the ready mixed industry have been so brief that they haven't yet faced their first depression.

Our business is plagued with the problem of too much business and not enough delivery units, and also with the companion problem of not enough business and too many trucks. We have to be able to give maximum service during periods of peak demands. Even in good times we are annually pushed on how to operate economically during "slow building" months. In years of reduced sales volume, the best producers in the industry may experience difficulty in operating profitably.

It is generally stated that ready-mixed concrete may be centrally mixed, truck mixed or "shrink mixed" (materials shrunk and partially mixed in the central plant mixer, with mixing completed in the agitating delivery equipment). In this discussion, we will refer to these different types of operation as central mix, transit mix and shrink mix.

Type of ready-mixed concrete plant, found frequently on the Pacific Coast, which serves transit mixer trucks

Regardless of the method of operation, these matters are basic:

1. Materials used must be fundamentally sound.
2. Aggregates must be uniformly well graded.
3. Ingredients must be accurately weighed and properly mixed.
4. Consistency of the delivered concrete must be closely controlled.
5. Segregation, in transit, during discharge and in job placement, must be prevented.

An efficient ready-mixed concrete operation has to be capable of producing the required quality of concrete with monotonous regularity. On job mixed concrete, the contractor knows when the testing engineer is going to sample and test concrete. On ready-mixed concrete, without word, any load of every day may be subject to inspection and report. Also as previously pointed out, the operator carries a moral responsibility on each and every load that is produced. To process and deliver uniform quality concrete, suitable aggregates must be used, mix designs must be based on the proper w/c ratio, appropriate weighing-mixing procedures must be followed, plant and delivery equipment must be adequate, competent personnel must be employed and effective sampling-testing routines must be carefully worked out. Whether central mixed or transit mixed, the delivered concrete should be uniform from batch to batch and of uniform consistency from the first to the last part of each load.

The amount of investment required to set up a ready-mixed concrete operation is largely dependent on two factors; (1) number of cubic yards production per hour, (2) whether the installation is to central mix or transit mix. In either proportioning or mixing plants, costs go up as yardage demands are increased. With the same plant equipment (other than mixer) the time required for proportioning is always less than that required for mixing. In speed of production, batching is easily first, followed by shrink mixing with central mixing a poor third. In efficient batching plants, as many as 50 weighing-charging cycles may take place in an hour. In an efficient shrink-mix plant, no more than 30 to 40 loads can be expected. In a well operated central mixing plant (one mixer), only 20 to 25 loads can be handled in an hour's time.

*Pres., Nicholson Concrete Co., Toledo, Ohio.

†From the 1941 Manual of The National Ready Mixed Concrete Association—"Henry Ford once said that two of the fundamental principles of business are:
1. To strive always for higher quality as well as lower costs.
2. To get the goods to the customer in the most economical manner."

An operator can always get more plant production for his money by installing a proportioning plant. Contrariwise, a producer can do better in his investment and operating costs of delivery equipment if he can take advantage of the bigger payloads made possible by central mixing.

In selecting delivery equipment, the possibility of strict enforcement of load limit laws should be considered. On single axle trucks, average weights on the rear axle are restricted to 18,000 lb. or 19,000 lb. On tandem trucks a gross weight of approximately 45,000 lb. is permitted with weights on the two rear axles generally restricted to a maximum of 32,000 lb. In recent attempts to get around load limitations, more weight has been placed up front. Because of the damaging effect on the two tires, don't go for more than 11,000 lb. (100 x 20 rubber) on the front axle despite what some truck and mixer manufacturers may tell you about the advantages of power steering. Check this warning with your tire man. If you are carrying extra weight up front, use nylon top quality tires and see to it that the front tires are always in excellent condition. Consideration of using your truck mixer as an agitator (with mixer motor and water tank removed) operating from a central mixing plant is better thinking than attempting to overload the front axle of a mixer truck.

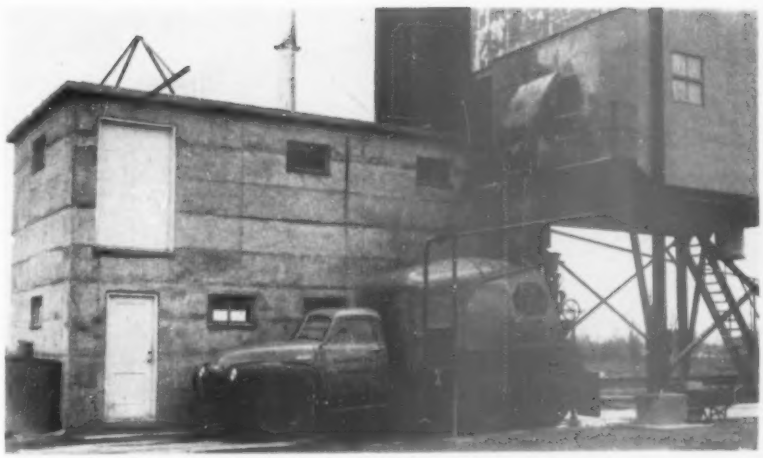
In addition to load limit laws, the payloads of the truck mixer and agitator are further restricted by ratings of the Truck Mixer Bureau and the National Ready Mixed Concrete Association. In one of the published standards for Specifications of Truck Mixers and Agitators (see current standard—National Ready Mixed Concrete Association) it is recommended that the rated capacity of a unit should not exceed the following percentages of the gross volume of the drum or container—

(a) Not over 57.5 percent when used for truck mixing.

(b) Not over 80 percent when used for agitating premixed concrete.

When the unit is used in conformance with this recommendation, the writer has always felt that the truck mixer is a better agitator than it is a mixer. Certainly two points must be acknowledged: (1) the basis for rating a central mixer is much more conservative than the basis on which the rating of a truck mixer is determined; (2) if shrink mixing is eliminated as an acceptable practice, then the 80 percent agitator limitation is no longer a fair requirement. If completely mixed concrete is being handled, the drum or container of an agitator needs only sufficiently excess volume that will permit, without causing additional grinding, necessary movement of the concrete to prevent segregation.

Students of the industry who agree substantially with this thinking, believe that ratings on truck mixers as



This central mix plant in the West has a pivoted hood over spout

mixers have already been extended to the limit and say that the rated mixer capacity should never be exceeded. They insist that the rating provides the minimum excess volume of a mixer drum necessary to properly process concrete. Standards provide that, under certain conditions, a total load not exceeding 110 percent of rated capacity may be mixed. Without attempting in any way to judge the matter of mixer ratings, it can be agreed in principle that overloading any mixer (plant, paver or truck) always "hurts" the quality of concrete.

• Whether to Central Mix or Transit Mix has long been a controversial question in the ready mixed concrete industry. For years, the author has been a partisan advocate of Central Mixing and non-agitating deliveries. He continues to favor such an operation. On the other hand, he has also been a Transit Mix producer and is cognizant of the many merits of transit mixing. At the present time, his company uses both agitators and non-agitators. He is conversant with many of the problems pertinent to both types of operation. It is at Mr. Nicholson's request that this statement be made.—EDITOR'S NOTE

In studying the comparative merits of transit mixing and central mixing, the matter of flexibility of operation rates important consideration. A mixing cycle always takes several minutes. At a speeded-up batching operation, a weighing cycle can be handled in 30 seconds. On busy days you can put lots of concrete through an efficient proportioning plant. Such possible speed-up is important only if you have the truck mixers to process and deliver the concrete. Under some conditions, a few extra truck mixers can be leased for the big job which you couldn't otherwise handle. To this extent, batching is more flexible than mixing. You certainly can't borrow a plant mixer from either a competitor or nearby dealer. However, increased batching production becomes relatively unimportant if you don't own the truck mixers or can't lease them.

No such speedup is possible at a central mixing plant where production is determined by the number of mixing cycles that can be completed. On the other hand, the central mix producer gets a break on delivery equipment. Delivery units (even if all agitating) cost less to own, operate and maintain. More cubic yards of concrete can be hauled in the same number of trucks. A substantial percentage of sales can be "pickups" handled in the customers own trucks. At some mixing plants, "pickup sales" amount to 20 to 25 percent of the total business. In addition, on some work the delivery of air entrained concrete in regular dump trucks is entirely acceptable. On peak days, a central mix producer may have to tell a customer that all the company trucks are busy, but he is generally able to add that the customer can pick up the concrete he needs, in his own delivery equipment.

There are several items of importance to all ready-mixed concrete producers:

(1) If you are operating different sizes of truck mixers, agitators or non-agitators, try to mount all units (provide higher frame sills for smaller mixers etc.) so that chuting heights are approximately the same, thereby permitting different sized hauling units to be used on the same jobs.

(2) Due to high cost of delivery equipment, you can only profitably gear operations to normal activity. In days of peak demands, consider the possibility of renting truck mixers. It is fundamentally unsound to invest in delivery equipment to the point where all customers are assured of getting satisfactory service on peak production days.

(3) In ready-mixed concrete opera-

A well-equipped ready-mixed concrete plant in the East

tions, we are primarily concerned with two ranges of slump, approximately from 2 to 4 in. and from 4 to 7 in. Many ready-mixed concrete producers are of the opinion that it is impractical to attempt the delivery of concrete in the lowest slump range (from no slump through 1½ in.). On the higher slump range, it is dangerous practice to deliver exposed (or strength required) concrete beyond safe w/c limits.

Before proceeding to study the problems, advantages and disadvantages of both transit mixing and central mixing, check (√) Fig. 1, below to help you determine the method which most efficiently handles some of the important problems of the ready mixed industry.

| Handled Best by Transit Mix | Problems of the Industry | Handled Best by Central Mix |
|---|---|---|
| | Plant equipment—operating and maintenance | |
| | Delivery equipment—operating and maintenance | |
| | Reliability of the Plant equipment | |
| | Reliability of the Delivery equipment | |
| | Speed of Production | |
| | Pick up Sales | |
| | Operation under load limit laws | |
| | Driver Training | |
| | Control over Quality | |
| | Economy of operations in slow periods | |
| | Plant Dust Problems | |
| | Total | |

## Transit Mixing

In transit mixing, the delivery of consistent quality concrete is assured only when the batching plant is equipped with proper controls, use of mixing water is closely regulated and concrete is mixed under approximately uniform conditions.

An efficiently operating batching plant is equipped with adequate machinery for elevating cement and aggregates, accurate fast operating scales, a weigh batcher of such size and shape as to quickly and completely charge (ribbon-feed) the largest truck mixer in use at the operation, a satisfactory water measuring unit, automatic dispensers for admixtures, suitable heating facilities for cold weather concrete and proper sampling-testing devices. Materials should be carefully weighed out, compensation should be made for the moisture content of sand, and consistency should be held within tight limits by establishing close control over mixing time and air content. Whenever possible, control over mixing water should be assigned to the weighman, not to individual drivers of the truck mixers.

As compared with central mixing operations, there are a number of advantageous points about proportioning plants. They are cheaper in cost, they are more simple to operate. Less time and money are required for erection. Because of greater portability and faster, more economical erection, they are the only answer for temporary setups. Operating and maintenance costs are lower. You effect sizable savings in your plant labor bill. You can handle more trucks with reduced waiting time. Fewer plant pile-ups occur. For dollar invested you can get twice the hourly plant production.*

On the other hand, because mixing is done elsewhere and the major investment is in truck mixers, the plant operation is likely to be a stripped down affair with important controls missing. In the eyes of many operators, the very nature of transit mixing tends to lessen the importance of controls. Why be able to furnish a prescription mix, anyway, when by adding water at the job, they'll change the mix? These operators never seem to realize that job changes become less frequent when through controlled processing practices, concrete of desired slump is consistently delivered.

Regardless of the length of the haul, a standard mixing cycle pattern should always be followed. Unless such an operating procedure is set, the delivery of uniform quality concrete is practically an impossibility. Specifications decree that you should mix a minimum of fifty revolutions (at mixing speed), a maximum of one hundred revolutions of the drum. I doubt that such a requirement will produce desired uniformity. The mixing in fifty revolutions of similar materials will not produce the quality or consistency of concrete processed in one hundred revolutions. I strongly recommend a mixing range of seventy to one hundred revolutions. In the handling of air entrained concrete, an even more strict control over mixing should be observed (seventy to ninety revolutions). Mixing cycles on all deliveries should be held within these limits. If a delay causes a holdup at the end of the mixing cycle or if the delivery point is not yet reached, revolution of the truck mixer drum should be continued at agitation speed.

If you mix too short a period you will not process a quality, homogeneous product. If mixing time is based on length of haul, consecutive loads will not be of the required consistency. If you mix too fast, premature stiffening of the concrete will probably develop. If you overload a mixer, its mixing efficiency will be greatly impaired.*

When truck mixers are used on short hauls it is poor operating policy to speed up the mixing rates in an effort to cut down the time of mixing. Through such practices, the quality of concrete is bound to suffer.

On specification work, proof of compliance with minimum and maximum mixing cycle standards is demanded through the requirement of counters or other mechanical means of verifying the number of drum revolutions.

A matter of determining significance as to the quality of the delivered concrete is involved in the discharge routines of the truck mixer operator. Discharge controls—reversing, speed control and discharge opening must be efficiently handled if properly mixed concrete is to be discharged from the mixer, free of segregation. A recently issued N.R.M.C.A. Manual (Control of Ready Mixed Concrete) puts it this way, "Perfectly mixed concrete in the drum may be "unmixed" by improper discharge control."

To effect a fast discharge of concrete, it is best to revolve the drum at full speed with the discharge door wide open. For intermittent discharge into buggies and wheelbarrows, it is advisable to manipulate the speed and direction of the drum. This means

*Note: See these Rock Products Articles: "More pointers in Plant Planning," December, 1952, page 183; "Equipment Requirements," February, 1953, page 181.

*Note: Before purchasing new truck mixer equipment, it might be advisable to obtain from the National Ready Mixed Concrete Association, copies of the two standards: (1) Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau. (2) Standards for Operation of Truck Mixers and Agitators of the National Ready Mixed Concrete Association.

frequent stopping, starting and reversing the drum. Mixers should be built to take this beating. Attempting to control the rate of discharge by varying the discharge opening is poor practice and generally causes segregation. Under most job conditions, with the discharge door wide open, discharge can be efficiently controlled by regulating the drum speed. Good operating practice requires that the rate of discharge of concrete from the truck mixer should be regulated by controlling the speed of the mixer drum revolutions and not by varying the size of the discharge opening.

If the last parts of loads are coming out "stony," be on the lookout for discharge control trouble. If you are experiencing difficulty with concrete showing a considerable variation in slump from the first to the last parts of loads, unless the mixer is in poor operating condition or is overloaded, improper discharge procedures are likely being followed.

One can't say too much about the dangers of excess water in concrete. Through the use of excessive quantities of water, concrete fails to meet strength requirements, quality of the hardened concrete is questioned, doubts are raised concerning the completed structure and the possibilities of deterioration of the exposed concrete greatly increased. In mix proportioning, only concrete of a safe w/c ratio should be designed. Everywhere down the line, on moisture compensation, water measurement, maintenance of water valves in truck mixers and job placement, care should be taken that concrete is suitable for intended job use. The ready mixed operator, plant personnel and drivers of the truck mixers must work as a team to protect the quality of the delivered concrete. Even if they do what they can to limit the water content of the concrete, the job of pleasing the contractor is still to be considered. In a transit mixing operation, there seems to be only one solution. If concrete of proper slump is delivered and the consistency of the mix is not acceptable to the customer, responsibility for adding water should be placed by obtaining a written authorization from the contractor.

*Our Form, front side:*

**The use in concrete of excessive quantities of water may do irreparable harm. We make every effort to deliver concrete of suitable consistency for intended job use. If load upon arrival is clearly too dry the driver will correct to the required consistency. If slump of one load is still not acceptable to you, the driver will add water upon obtaining your written authorization.**

**Please do not make a regular practice of asking the driver to add water. Please call the dispatcher so that concrete meeting your requirements can be processed under engineered controls at the plant.**

**Large batching plant, to the left, operated by sand and gravel company. Note bulk cement delivery trucks in foreground**

*Reverse side:*

**On load covered by delivery ticket No. _____, the concrete was approximately _____ in. slump.**

**I authorize the addition of water.**

**Signed**_____
**(contractor)**

**By**_____
**(contractor representative)**

On deliveries there are a number of undoubted advantages in a truck mixer operation. Long hauls are no particular hardship. In warm weather, mixing can be deferred to the last several minutes before placing, thus permitting the longest possible time for working the concrete. If lengthy job holdups occur, water can be added and the concrete remixed. The same solution makes possible a more efficient processing of concrete in which porous aggregate is used. Transit Mixing is particularly effective in the handling of returned concrete. On the return trip, concrete remaining in the mixer drum can be kept in good condition by both adding water and agitating the drum.

The importance of intelligently handling the problem of returned concrete can be shown by the experiences of a Kansas ready mixed concrete producer. In a nine week period, during which time 30,000 cu. yd. of concrete were sold, a check upon returned concrete showed that 201 cu. yd. (approximately 0.7 percent) were actually resold. These nine week figures indicate that this producer realized through proper handling of returned concrete, an extra $1200 to $1500 profit. In addition, concrete returned on the last trips of each day was used in the making of splash blocks at additional profit to the producer. The central mixed producer operating non-agitating equipment cannot use returned concrete in later deliveries. In fact for him, the disposal of returned concrete is an important cost item.

On deliveries, a transit mixing operation also has some objectionable features. Transit mixing is the most expensive method of hauling concrete. An expensive, single purpose unit, hardly more than half full (load 57.5% of drum capacity) does the hauling. All specially built, single purpose machines cost more to own and operate. By no stretch of the imagination is the truck mixer an exception to this rule. The truck mixer is slow in traffic; not too fast in discharging the concrete. The high discharge type is not too effective in handling low slump concrete. There is apt to be an absence of effective controls over mixing time, slump and air contents. The presence of cement balls may be an added complication.

There is a question in the minds of some students of the industry whether, generally speaking, truck mixers are efficient mixers. They refer to many claims of inadequate mixing. Some highway departments are critical of truck mixer use although figures worked out by the State of Ohio Highway Department (see Misc. Publication No. 31, page 3, N.R.M.C.A.) showed similar average strength and air content results between road pavers and truck mixers. These students see cement balls being discharged as part of the loads. They know how some producers take great pains in developing loading procedures to prevent the formation of cement balls.

They point out that by reducing the load and thus providing extra mixing area in the drum, the formation of cement balls is generally prevented. Certainly in any operation, the presence of cement balls cannot be defended. If such are regularly present and changing loading procedures doesn't correct the condition, then only a load that can be efficiently mixed should be allowed regardless of the rating of the available mixing unit.

## Central Mixing

An efficient central mixing plant consists chiefly of a large central mixer, satisfactory overhead bins for storage of aggregates and cement, proper elevating equipment, fast acting screw conveyors or F-H Airslides for feeding cement to the weigh hopper, a weigh hopper of proper shape and adequate size, accurate scales, efficient metering devices and, when required, suitable heating facilities.

A mixing plant may be purchased from several sources of supply or may be completely furnished by one manufacturer. Some producers believe that the buying of a complete "package plant" is advantageous in that component parts go together easier so that erection can be promptly completed at minimum cost and the whole package can be quickly hooked-up to water, steam, air, hydraulic and electrical service outlets. These operators say that, under most conditions, purchase of equipment represents only half the necessary investment and add that the buying of a good "package plant" assures a saving of 25 percent in erection costs.

Whether you purchase a complete plant, from one manufacturer, or buy plant equipment from several sources of supply, make certain that you wind up with an efficient, low cost plant operation.

Any plant, "package" or otherwise, should be designed to provide simple, safe construction with maximum savings in over-all height, weight and space. The design should be such as to provide required capacity, maximum economy of operations and low maintenance costs. In a well planned plant, elevating and weighing facilities are geared to mixing cycle requirements; speedy accurate weighing is provided and fast thorough mixing is assured with provisions made for close control over slump, air limits and moisture content of the aggregates. The over-all operation of a plant should be geared to the delivery equipment in use. If tandem hauling units are being operated, the weigh hopper and mixer should easily handle 5 cu. yd. of concrete. If only the use of single axle units is being planned, then a 3 cu. yd. weigh hopper/mixer combination should be installed. If the anticipated plant production exceeds 20 loads per hour, a second plant mixer should be planned for, if not purchased.

The time to begin planning for expansion is when you make the original investment in plant equipment. Before selecting equipment, the operator should make a careful study to determine anticipated daily production and future requirements. The selected plant should be capable of greater production, (by approximately 50 percent), than the calculated daily business.

In a central mixing plant, scale-weigh hopper arrangements should always be such as to assure completion of the weighing cycle well within the time limits of any possible mixing cycle. A plant should have two ratings: one for complete mixing and one for shrink mixing. Normally, a plant can efficiently shrink mix 50 percent more concrete than it can central mix. In a shorter shrink mixing cycle, quality, uniform slump concrete can still be processed. The processing of uniform concrete cannot be done in a 30-sec. cycle as some producers attempt to do. If the plant mixer is equipped with an accurate slump determinant, an efficient mixer operator is able to establish close control over consistency, in a 1½-min. mixing cycle. Loads should not be discharged until water has been added to bring the concrete within desired slump limits and the pattern on air entrainment has been determined. Controls over consistency should be substantiated before any mixing plant is approved as a shrink mix operation. Shrink mix operators who do not regularly produce uniform quality concrete are a discredit to the industry.

At any central mixing operation, standard mixing practices should be adopted and be regularly followed. The length of each mixing cycle should always be determined by an accurate mixer timer or counter. Both central mixing and shrink mixing cycles take as long to complete on peak days as they do on slow days. If your central mixing cycle is 3 min., you should limit your plant production to 20 loads per hour. If your shrink mixing cycle is 2 min., 30 loads per hour should be your top production. The processing of uniform quality concrete is largely dependent upon strict adherence to standard mixing procedures.

To increase the production capacity of a central mixing plant, two courses are open: (1) Add a second plant mixer or, (2) change over to shrink mixing. In shrink mixing, the central mixer, in a faster mixing cycle, shrinks the concrete ingredients so that a bigger payload can be hauled with mixing completed in the agitating delivery equipment.

Where speed of processing is important, the use of agitators operating from a shrink-mix plant should be considered. At least three shrink-mixed loads can be handled in the same time required to completely mix two loads. In order to take care of a big job, superimposed on top of his regular business, a central mix producer may find it necessary to change his operation over to shrink mixing.

In any one plant, if you are going to central mix, then just central mix; if you are going to shrink mix, then just shrink mix. At one operation, never try to do both! Serious trouble is certain to develop. The wrong concrete will get into the wrong truck. If you are operating both agitators and non-agitators, you would be in trouble if a shrink mixed load was placed in a non-agitating unit. When operating both types of delivery equipment, always completely mix each and every load. A producer operating several plants at which both agitators and non-agitators are used, should stop the use of non-agitating equipment at the plant where the speed of shrink mixing is required. If you are only operating agitating units, you can either shrink mix or central mix. Decide upon one method of operation and always follow the same procedures.

A principal advantage of central mixing is one man control of the concrete. It is admittedly easier to effectively train one man in the art of processing uniform concrete, than to attempt the education of ten or more truck-mixer drivers. Another advantage is that the central mixer is a more efficient mixing unit than the truck mixer. With controls that are available for central mixing operations, it is much easier to produce a uniform quality concrete.

A substantial financial advantage is the gas savings resulting from the removal of the mixer motor. The mixer motor is not required on either agitating or non-agitating delivery units. In operating costs, figures obtained from "Hilltop Building Materials, Inc., of Cincinnati, Ohio" show that approximately one third of the gas bill goes toward providing fuel for mixer motors. In addition to obtaining a fuel saving of at least 25 percent, getting rid of the mixer motor eliminates a principal maintenance cost item and sharply reduces the duties of maintenance personnel.

In central mixing, you are able to haul bigger legal payloads; operating and maintenance costs on delivery equipment are cut. There is less to go wrong. With down-time reduced, there is improvement in service. Relieved of the responsibilities of measuring water and mixing concrete, the driver can give his full attention to efficiently unloading the truck.

Agitating the plant mixed concrete in the hauling unit, (at agitating speed 2 to 4 r.p.m.), can be efficiently handled by a power take-off. A 50 percent bigger payload is actually coupled with a substantial saving in fuel and labor costs. A fleet of 18 agitators can deliver in one trip as much concrete as 30 truck mixers are able to handle in one round. The importance of this comparison appears even more outstanding when one realizes that such improvement in service is accompanied by savings in operational and maintenance costs.

Some producers are delivering 5 cu. yd. of quality central mixed concrete in a 3 cu. yd. truck mixer. Used as a truck mixer, the unit would deliver, daily, 18 cu. yd. in six trips. Used as a revolving carrier, the unit in six trips could handle 30 cu. yd. With one unit, a central mixed producer could possibly handle 12 cu. yd. more daily. He should be able to average an additional 9 cu. yd. His actual increase, will be dependent on whether, at the

(Continued on page 192)

# NEW MACHINERY

## Truck Crane

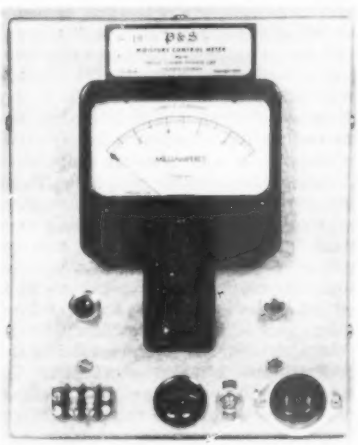
RAY-LIND MANUFACTURING CO., Iron River, Mich., has announced a line of ½- to 2-ton capacity, truck-crane loaders. The crane unit mounts directly behind the cab, moving the

Self-loading truck crane

truck body back on the frame. The loader is available in two models, one with an elevating mast and a boom swing of 170 deg., and one with a "fold-over" super-structure with a boom swing of 360 deg. In the "fold-over," the top portion of the structure may be folded down for traveling, and for bridge and door clearance. Standard loaders have a pick-up radius of up to 16 ft. Power for hoisting is supplied by the truck engine through a power take-off.

## Moisture Control Meters

THE P & S MOISTURE CONTROL METER, illustrated herewith, was developed and perfected by Milton Posey and Roy Sargent. Mr. Posey was in the concrete products machinery business for many years and for the past six years has operated the Precast Concrete Products Corp. in Atlanta, Ga. Mr. Sargent is an electronics engineer of many years experience. The moisture control meter checks the moisture in each individual batch of materials to be mixed, and adds additional water to make a batch of accurately controlled moisture content.



Meter checks the moisture of individual batches to be mixed and adds additional water for controlled moisture content

The meter operates electronically with electrodes in the mixer and a solonoid valve on the water supply line. The meter is manufactured at Atlanta, Ga., and installations have already been made in many of the leading plants in Georgia and South Carolina. It is planned to step up production by the first part of 1954 and meters will then be available to the trade. Sales and installations will be handled by Roy Darden Industries, Inc., Post Office Box 95, Northside Branch, Atlanta, Ga.

## Concrete Mix Tester

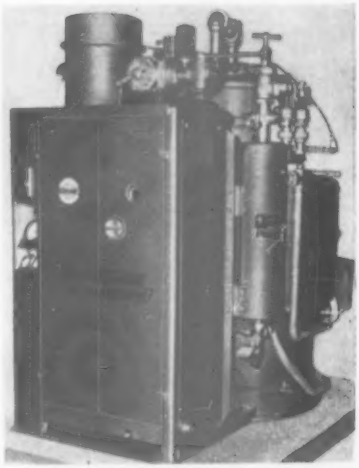
CIVIL ENGINEERING RESEARCH LABORATORIES, Tensile Works, Windmill Rd., Sunbury-on-Thams, Middlesex, Eng., has developed the "S.G." portable concrete mix tester which checks

Tester checks the water-cement ratio of concrete mix

the water-cement ratio. It is comprised of two sections, the case housing the controls and instrument panel, and a "prodder" with electrodes at the base. The instrument, complete with non-spillable batteries, weighs 24 lb. A battery-eliminator, which permits operation by electricity, is available as accessory equipment. By connecting the eliminator to the batteries, it can be used alternatively for charging the batteries overnight.

## Steam Generator

VAPOR HEATING CORP., 4501 W. 16th St., Chicago 23, Ill., has developed the "Vapor-Clarkson" steam generator, Model OKJ-4740, which can change from fuel-oil to natural gas by flipping a switch and without interrupting steam output. The generator is reported to develop full working steam pressure up to 300 lb. pressure, in less than three minutes from cold water, and makes 1500 to 5000 lb. of steam per hr. Once started, automatic controls take over, modulating the steam output to meet a changing steam demand. The pressure may be changed from 10 to 300 lb. by turning a control.



Combination fuel generator develops 300-lb. steam pressure

A patented steam separator removes excessive moisture and water treatment particles from the steam to provide a 99 percent dry, clean steam directed through the stop valve to the steam line. Safety controls include: the steam temperature limit control; low water shut off; two safety valves; overload relays; electric eye and others.

The complete generator package includes a 7½-hp. electric motor, blower, feed water pump, steam separator, steel coils, and the controls. Overall dimensions are 50 x 80 x 73 in., and the weight, 6000 lb. The generators are also available in sizes producing 500, 1000, 3000 and more pounds of steam per hour and up to 600 lb. steam pressure.

## Lift Truck Transmission

CLARK EQUIPMENT CO., Battle Creek, Mich., has announced production of Hydratork Drive, an automatic transmission which makes it possible to operate a gas-powered fork lift truck with an accelerator, a brake pedal and a forward-reverse selector lever on the steering column. The unit design eliminates the need for a gear shift for high and low gears and a clutch and clutch pedal. The selector lever is connected with an electric switch which prevents engine starting unless the lever is in neutral. "Inching" is accomplished by partially depressing and releasing the brake pedal which has a wide extension to facilitate right or left foot-control. Further depression of the pedal engages the standard hydraulic brakes. The transmission housing is designed for maximum servicing accessibility.

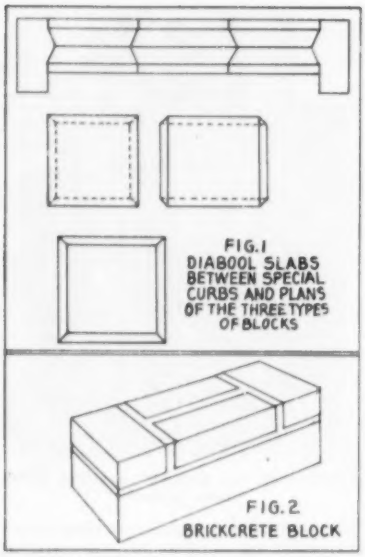



**Fig. 1: Diabool slab, originally used for revetments on sea dikes.**

**Fig. 2: Brickcrete block is a combination clay brick and concrete unit**

# Precast Concrete Slabs For Industrial Floors

## Concrete products manufacturers in Holland have designed several types of precast floor and pavement slabs which have found a wide market in that country

By P. F. VAN DER MEULEN BOSMA*

MANY DIFFICULTIES are encountered in making good industrial concrete floors. Different types are needed, but this article will only deal with various types of precast concrete slabs produced in Holland, describing their production and use.

For light duty floors and parking pavement, the regular 30 x 30 cm. (11 13/32 x 11 13/32 in.) concrete slabs, with or without a 1/16-in. chamfer, and from 2 to 4 in. thick are used. These slabs are made on special presses or tampers, with a production of up to 2500 per day with two or three men at the machine. Compression strengths on 2-in. cubes vary from 6400-15,000 p.s.i., according to quality and type of materials. The cheapest slab is made of a 1-2-3 gravel mix (1 in. maximum size) with a ¼-in. wearing surface of a 1-2 cement—coarse sand mix. Much better slabs are made from crushed basalt in the sizes 3/16-¾ in. for the normal mix and 1/32-⅛ in. for the wearing surface. Abrasion in the 550-yard test on the Amsler machine varies from 3/64-3/32 in. (standard test).

There is a large market for paving slabs which are always kept in stock in great quantity and in various qualities.

In places where heavy traffic and more abrasion is encountered, a higher quality of slab is used. A few special products of N. V. Betonfabriek "De Meteoor" De Steeg, Holland, are described below:

### Wear-Resistant Surfaces

Stelcon anchor slabs have a ⅛-in. perforated steel sheet as a wearing surface on a basalt concrete slab. The anchors are pressed from the perforations. It is a very good floor for foundries, boiler houses, dairies, etc., where chemical attack with rough treatment is possible. The size generally used is 11 13/32 in. square by 1 5/8 in. to 3 in. thick. Larger sizes are also made. This floor system is made under Dutch patent No. 21.769 and many foreign patents.

Stelcon armor slabs are made of strong concrete with a wearing surface of steel-concrete: steel chips with cement. Abrasion with the Amsler standard test is 0.01-0.02 in. Sizes are 11 13/32 in. square by 3/8 to 3 in. Thickness of wearing surface is 1/64 to 3/8 in. Some corrosion of the steel is possible but for special cases a stainless material can be used (also for floor slabs).

Other Stelcon slabs are made with wearing surfaces of very hard crushed rock, sometimes combined with ordinary or stainless steel chips. Another special product is a concrete slab for slaughter houses made of white portland cement mixed with a red or yellow pigment. The aggregate is a stainless hardener combined with crushed rock. Abrasion in the Amsler standard test is 1/32 to 3/64 in. Slabs are 11 13/32 in. square with varying thicknesses. The slabs can be made with exposed aggregate to prevent slipping.

Except for the anchor slabs, the same type slabs are also produced and sold by other firms, but only on a small scale.

All the above mentioned slabs can be made on standard paving slab machines, and they are easily laid on a well-compacted sand bed.

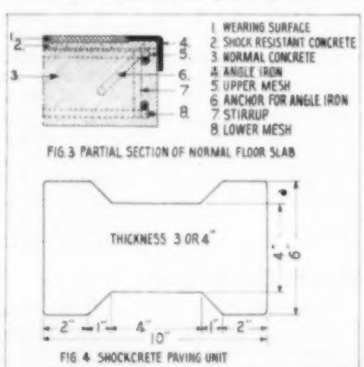



**Fig. 3: Partial section of concrete pavement slab used between railroad track. Fig. 4: Shockcrete pavement shaped to prevent "creeping"**

Other manufacturers have developed systems to obtain a good, flat floor. One of these slabs, which started out as a revetment unit on many sea-dikes in southwest Holland, is the Diabool-block which is made in special molds. They can be produced with electric or pneumatic tampers or on a vibrating table.

The top of this block is 11 13/32 in. square, and the thickness is 7⅛ in. Special colored or abrasion-resistant wearing surfaces are possible. The block are placed between special curbs 10 in. high. Three types of block are needed to make a floor. These types are shown in Fig. 1 and are patented under No. 48866. (N. V. De Hoop, Terneuzen, Holland). Another type of pavement, also a revetment unit, is the hexagonal block with sides of 5 in. or 6 in. and 4 to 12 in. high.

There are also many places, where it is better to use material other than concrete, but even there concrete has found its place.

### Clay-Concrete Slabs

For cattle markets, garages and oil depots, the brick-concrete block is used. Dimensions are 8¼ x 16⅝ x 6 in., weighing nearly 60 lb. On four first-quality clay brick, placed flat in the mold with mortar, a very strong and dense concrete is tamped. It forms an ideal non-slip surface with a good resistance against abrasion and chemical attack (see Fig. 2). This block was produced and sold by N. V. De Meteoor, but it is possible that the patent rights have expired.

Before the war, Mavewa slabs were produced for similar purposes. These concrete slabs have a wearing surface of a special cold asphalt mix and were made in thicknesses of 5/8 to 4 in. on ordinary paving slab presses. It is an ideal elastic floor for workshops as it prevents much damage to falling parts and is warmer to the feet. The joints close under the pressure of the traffic until after a short time the floor looks like a normal asphalt floor. When the slabs are taken up, however, they can be used undamaged on the same or other place. The closing of the joints is very important when chemical attack of the concrete is pos-

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sible. So far, production has not been resumed after the war.

### Drainage Slabs

The Dutch Shockrete Ltd. produces another type of slab, called the Drainata slab. This slab is made with a "no fines" concrete and is ideal for very wet spots. The wearing surface is made of ¼ in. gravel and cement, and the back-up mix is made of ½ to ¾-in. gravel with cement. The surface can be colored. The Drainata slab is laid on a concrete floor with a bituminous coating and gutters at designed distances. Every 11½ in. square slab has on the underside four little canals, running parallel with and at approximately 3 in. from the sides. These canals collect the water and send it over the concrete floor to the gutters.

All slabs and block described so far have in all cases, a bearing area of approximately 1 sq. ft. and only for very special circumstances are they made in larger sizes; for example, 16 x 16 in. or 20 x 20 in.

### Paving Between Rails

On docks, in factories, warehouses and at harbors, where big fork lift trucks, cranes and other heavy equipment are used, a very heavy wheel-load is possible, with a combination of much abrasion and sometimes chemical attack. For this purpose a few plants produce floor slabs, the normal dimensions of which are: 6 ft. 6¾ in. square by 4 in. For use between railway tracks (4 ft. 8½ in. gauge) the dimensions are 6 ft. 6¾ in. x 4 ft. 3 in. x 4 in., and for use between double tracks, 6 ft. 6¾ in. x 3 ft. 8 in. x 4 in. Details of this floor slab are shown in Fig. 3.

A standard 6 ft. 6¾ in. square floor slab is made from the following components: Reinforcement comprises two meshes of $\frac{5}{16}$ in. or ⅜ in. round mild steel bars with 8 in. spacing. The lower mesh is supported on concrete bar spacers, while the upper mesh is supported on the lower with steel spacers. Every contact point of the meshes is electrically welded. The concrete cover on the steel is ⅜ in. on sides and bottom and ⅝ in. on top. The wearing surface is protected on the sides by an angle iron $1\frac{5}{16}$ x $1\frac{5}{16}$ x $\frac{5}{16}$ in. or 2 x 2 x $\frac{5}{16}$ in. This angle iron is anchored to the concrete with $\frac{5}{16}$ in. anchors at 8 in. intervals. The space between the reinforcement is filled with a dense gravel-concrete mix which is jolted or vibrated, until the concrete is level with the upper mesh. Then a ⅜-in. layer of shock-resistant concrete is placed. This concrete contains more cement with a special crushed rock or basalt aggregate. Then comes the ¼ in. thick abrasion-resistant wearing surface, made of crushed steel chips or carborundum.

Carborundum is in many cases preferred for a non-staining non-slip floor. Finishing and compacting is done in many plants with electric rotating trowels. These machines finish the surface exactly level with the angle iron.

Due to the angle irons, a floor of thes. slabs is practically jointless. When placed between railway tracks, no contra-rails are needed. A standard slab weighs approximately 2400 lb. and has two or three slots to accommodate hooks for hoisting. Placing is often done by truck cranes on a good compacted and levelled sand bed.

Compression strength of the concrete is approximately 8500 p.s.i. and resistance to abrasion on the Amsler standard test is 1/128 to 1/100 in. It is said that a normal slab, placed with its four corners on 1 ft. square supports, can have a 30-ton load on a 1 ft. square area on its center, without showing cracks.

### Other Light Floor Systems

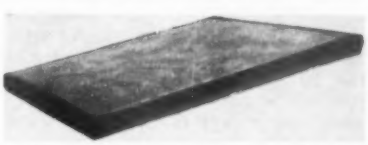
Other plants produced lighter floor slabs with the same resistance against abrasion, but with a thickness of 2 to 3 in. and a single mesh.

Patents have been applied for Shockcrete pavements by the N. V. Schokbeton of Zwijndrecht (see Fig. 4).

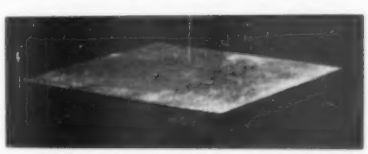
The interlocking units are shaped to prevent creeping of the pavement. The compression strength is between 7000 and 8000 p.s.i. The tops are chamfered and finished by steel brushes to obtain a non-slip surface. Wearing resistance is unknown.

Another patented paving unit is the Trief unit of Belgian origin. Dimensions are practically the same as those of the Shockcrete units. The upper part of the block is said to be rectangular, but the lower part should have the same shape as the Shockcrete unit. It is also said that very high compression strengths are obtained (approximately 17,000 p.s.i.) when the blocks are made of the patented Trief cement. This cement is composed of approximately three parts of special treated blast furnace slag and one part of normal portland cement, which are ground together.

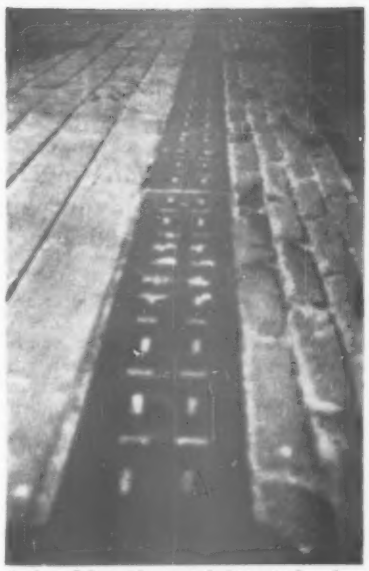
Shockcrete pavement of interlocked units



Floor slab for heavy traffic around harbors



Plain paving slab (30- x 30- 4½-cm.)



Anchor slabs with pressed sheet steel surface

## Autoclaved Building Materials

THE JOURNAL, *Zement-Kalk-Gips*, in December, 1952, published a special 50-page report written by Joachim Endell, giving detailed discussion of raw materials, lime and silica. The hydrous calcium silicates and aluminates are described, as well as the process of steam hardening. Sand-lime brick are given considerable attenion, as is autoclave hardened concrete. Lightweight products made from lime are covered very fully, with ample references to the literature and patent art. The building materials which can be made from lime and either blast furnace slag, clay or cinders are also amply described.

The conclusion is drawn that strengths obtained in the autoclave are due to the formation of gelatinous calcium hydrosilicates, reaching a maximum at about 36 percent lime and 64 percent of very finely ground silica. A temperature not higher than 180 deg. C., for a period not more than 20 hr., is recommended, to avoid changing the gel to crystals. More than 200 references are given.

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MATOAKA STONE CO., Bartlesville, Okla., recently began operations at its hot-mix asphaltic concrete plant, producing up to 500 tons of mix per day. Tom King is manager of the new company.

## A.C.I. Regional Meeting Reviews

# NEW CONCRETE DEVELOPMENTS

**American Concrete Institute regional meeting at Houston, Texas covers advances in lightweight aggregate concrete, precast concrete, prestressed concrete, design practice, and European observations**

THE INITIATIVE of the Southwest was evidenced at the regional meeting of the American Concrete Institute held at the Rice Hotel, Houston, Texas, October 28-29. The program and all arrangements were handled by a local committee, with only nominal supervision from the Institute staff; in contrast to the program and conduct of the annual conventions, which are in the hands of the Institute's National Technical Activities Committee. Papers presented at Houston dealt almost entirely with problems and activities of the region, which was defined as "Texas plus the four adjacent states of Louisiana, Arkansas, Oklahoma and New Mexico." The attendance of approximately 350, including wives, came largely from that area.

In his remarks opening the first session on Thursday morning, October 28, Frank W. Chappell, consulting engineer, Dallas, Texas, pointed out that practically every building incorporates concrete at some place in its construction, and as a consequence concrete is of interest to all owners, even householders. He mentioned that the use of lightweight aggregates has been growing rapidly throughout the country, and that of the 22 plants in the U.S. producing expanded shale, or clay aggregate, 11 are located in the five-state area of Texas and the adjacent states. Lightweight aggregate of this type will be used in the new Statler Hotel in Dallas. He also announced a profound study of prestressed concrete in highway slabs as a protection against cracking due to volume change.

### Texas Expressways

In a paper giving a comprehensive summary of the planned system of urban expressways for the Houston area, W. J. Van London, Texas Highway Department, in charge of design and construction of these expressways, mentioned that the mileage of new highways built in the United States in 1952 was not sufficient to park all the automobiles manufactured that year, as indicating the need for even greater activity in highway construction. The system of expressways planned for Houston and vicinity, under a 20-year program, will comprise approximately 240 miles of highway, estimated to cost about $400,000,000. Extended studies are being made of access "pretzels" at all separated grade intersections. Of this system, a 9½-mile "freeway" leading from the near-downtown to the southwest has been built; the traffic-density has already reached 85,000 vehicles per day, and is increasing rapidly, with an estimated saving to the public of $14,000,000 in four years. The pavement on this stretch is 10-in. concrete, mixed with 4½ sacks of cement per cu. yd., laid on cement-stabilized soil base. Mr. Van London stated that transit-mixed concrete had been very satisfactory. He reported that a recent condition-survey after four years of use indicated that 80 years of service under present traffic could be expected before major repairs would be needed.

Prof. Sophus Thompson, Southern Methodist University, Dallas, Texas, reported on tests of the shearing strength of anchor bolts embedded in concrete, which have been conducted as laboratory work for undergraduate theses since 1941. The tests included ¾- and 1-in. bolts embedded 6, 8, and 10 in. in blocks of concrete. The results with different strengths of concrete indicated practically no increase in shear for strengths above 2500 p.s.i. A comparison with the provisions of the 1940 code indicated that the code represented a factor of safety of 9, whereas the speaker suggested 4½ would be safe.

### Ribbed-Slab Forms

A recent development in forming for ribbed-slab construction by using corrugated-box forms in place of metal pans, was described by H. C. Pfannkuche, Portland Cement Association, Fort Worth, Texas. Three jobs have been built to date, using boxes 20 in. wide, 40 in. long, and 10 in. deep, made of corrugated board, smooth on both sides. The boxes are shipped from the factory knocked-down, with paraffin treatment on the outer side. The boxes are assembled on the job, with the addition of stiffeners, by use of stapplers. The boxes can be designed for removal after concrete is poured, if desired. They are strong enough to support runways for buggies. The speaker stated that the exponents of this system claimed low costs for material, assembly, and placement in the forms.

### Volcanic Cinder Concrete

Experiments with concrete made with volcanic cinder aggregate found in northwest New Mexico, known as Geolite, were reported by Prof. Fred J. Benson, Texas A & M College. Prof. Robert Galloway had collaborated in the work. This cinder has a dark red color. When crushed for aggregate, the coarse weighs 58 lb. per cu. ft., and the fine 64 lb. Concrete mixed with six sacks of cement per cu. yd. had a compressive strength of 2000 p.s.i. Masonry building units and brick met specification requirements for strength, but were high in absorption.

### European Observations

At a luncheon assembly, a cordial welcome to Texas was extended by H. E. Bovay, representing the Texas Society of Professional Engineers. Henry L. Kennedy, Boston, Mass., president of the American Concrete Institute gave an exceptionally interesting report of his observations on a business trip to Europe this summer, during which he discussed the work of the Concrete Institute with groups in several cities. In Italy he found good examples of mass concrete which had been placed very dry. He observed that some of the ancient structures, which are popularly reported to be built of concrete, were actually built with brick and lime mortar. A specimen of 2000-year pozzolan and lime concrete, which was subjected to slow freezing and thawing on his return to this country, disintegrated at only seven cycles. In Switzerland, concrete was handled very dry, being pounded and vibrated into place. In Germany, some of the Autobahn concrete was considered by Mr. Kennedy as inferior, according to our standards; but he was impressed by the excellent clean-up and reconstruction job which has been accomplished in some cities which were damaged by war-bombing. In both Sweden and England he found great interest in pre-stressing, with development in many respects in advance of practice in the U.S. He reported that the A.C.I. and its journal are held in high regard in European countries, and that findings published in the American literature are accepted widely.

### Design Practice

The afternoon session was devoted to lightweight structural concrete, with Prof. Phil M. Ferguson, University of Texas, serving as chairman. The first paper, presented by John A. Murtin, Texas Concrete Products Co., Dallas, Texas, discussed

"Design Practice" in this field. The term "lightweight aggregate" as used in this and subsequent papers refers to expanded shale; other lightweight materials are not used extensively in structural concrete in the Texas area. The paper reported that compressive strength of the shale concrete is much higher at 42 and 60 days than at 28 days. The fact that this concrete is not as "mature" at 28 days as gravel concrete was attributed to the continued hydration of cement due to the water available in the porous aggregate.

The use of expanded shale from a Ft. Smith plant was discussed by Prof. J. R. Bissett, University of Arkansas, Fayetteville, Ark. Six sacks of concrete with this material, sized to a maximum of ⅜ in. but deficient in fines and weighing approximately 62 lb. per cu. ft., developed a strength of 3800 lb. at 28 days. Beam tests showed weakness in diagonal tension. The elastic deflection was somewhat less than parallel tests with gravel concrete.

R. B. Rogers, Texas Industries, Inc., Dallas, reported recent tests of concrete in the hull of the "Selma," a concrete ship built at Mobile, Ala., in 1919. After 34 years, specimens from above the water tested 8800 p.s.i., and from below water, 11,000 p.s.i. Pull-out tests of the ⅜-in. smooth reinforcing bars showed a bond-strength of 516 p.s.i. The concrete shell was 4 and 5 in. thick, made of expanded shale (Haydite) with 11 sacks of cement per cu. yd., and heavily reinforced with smooth bars. When the hull was converted to an oil barge some years ago, the interior was coated with asphalt to prevent absorption of oil by the concrete. Accordingly, the strengths observed were considered as developed in the original concrete under the exposures experienced over the years.

Tests on lightweight structural concrete, designed to develop 4000 p.s.i. in 28 days, were reported by Cedric Willson, also Texas Industries, Inc. This concrete, made with expanded shale, weighed approximately 105 lb. per cu. ft. wet and 98 lb. dry. It was found advantageous to use a dispersing agent. As mentioned by another speaker, a greater gain of strength after 28 days was noted than for heavy concrete, in both air-dried and moist conditions.

## Lightweight Precast Concrete

An unusual application of pre-cast, lightweight concrete members at the Freeport, Texas, plant of the Dow Chemical Co. was described by A. C. Blackburn of that company. In 1951 the installation of pipe lines required about 300 supporting stanchions, ranging in length from 6 to 20 ft. After foundations for steel members were in place, the prospective delay in obtaining steel stanchions prompted a shift to precast concrete, with foot-plates and fittings welded to the reinforcement. The only difficulty encountered with the concrete members was occasional spalling adjacent to the welds, due to heat. The initial cost of the concrete was about the same as steel, but the low cost of maintenance is effected to show concrete to be cheaper over a period of years.

An evening session for which W. P. Moore, consulting engineer, Houston, Texas, was chairman, was devoted to moving pictures of several types of concrete construction in the southwest. Jean H. Knox, The Preload Co., Dallas, Texas, presented a 1,000,000 gal. reservoir erected at Ft. Bowie for the Corps of Engineers. This tank, 135 ft. in diameter by 31 ft. deep, erected on top of a 100 ft. high pedestal of the same diameter, was post-stressed by the type of wire-wrapping which has been used widely for large circular tanks. Geo. P. Rackle, George P. Rackle Co., Houston, Texas, discussed the economy obtained in constructing a large warehouse by using precast, prestressed 40-ft. beams and 20-ft. wall panels, all cast with expanded shale concrete.

In view of recent publicity of offshore drilling of oil wells, a presentation by H. B. Miller, Raymond Concrete Pile Co., Houston, Texas, was very timely. The concrete cylinder piles for supporting the platforms for drilling rigs, are produced in units of 20 ft. length, usually 30 in. in diameter, which can be added together for a total length of 128 ft. The 20-ft. lengths are post-stressed with 8 or 12 cables, each comprising 12 wires, which are grouted under pressure so that each strand is bonded in place.

The evening closed with views of a four-story, 80,000 sq. ft. parking garage in Dallas, presented by Merwin Beavers, Texas Concrete Products Co., Austin, Texas. Precast floor slabs were used. The entire building was erected in 60 days, at an over-all cost of $2.46 per sq. ft.

## Prestressed Concrete

Prestressed concrete was the principal topic of papers at the forenoon session on Friday, October 30, for which Cedric Willson was chairman. Fred A. Koebel reported on tests of I-section roof beams, 6 x 6 x 10 in. x 20 ft. long, made of Haydite concrete containing 6¾ sacks of cement per cu. yd. The beams were post-stressed with tension in the steel of 125,000 p.s.i. Two beams, one with the steel grouted and the other not grouted, were maintained under designed load for four months, and then loaded to destruction. Both beams showed a loss of approximately 25 percent of the initial stress due to creep and stretch, but the grouted beams carried a greater load before failure than the non-grouted beams. The grouted beam failed from diagonal tension.

Based on data from tests with 6-x 12-in. x 10-ft. rectangular beams, both prestressed and nonstressed, a highly analytical paper by Professors Eugene Zwoyer, University of New Mexico, and C. P. Siess, University of Illinois, presented by Prof. Zwoyer, developed formulae for performance values of both types of beams. In the tests the first cracks were vertical in the flexure zone, but failure occurred along diagonal cracks resulting from tension.

Views of a practical application of the value of prestressing were given by Professors Adrian Pauw, University of Missouri, and M. H. Thibodeaux, Rice Institute. To study the droop of a proposed 23-ft. cantilever canopy for a store, experimental quarter-scale models with conventional and prestressed reinforcing were built and tested under uniform loading. The tests indicated the feasibility of introducing a camber by prestressing which overcame the droop with conventional reinforcing which the designers of the building had considered objectionable.

M. M. Lemcoe, Southwest Research Institute, San Antonio, Texas, described the construction of a two-story laboratory building for that organization by the Youtz-Slick method. The first-floor slab was poured on the ground, and the steel columns erected at 24-ft. centers. The prestressed roof slabs were poured on this floor, and raised into place by jacks mounted at the top of the columns. When in position, rings at the corners of each bay were welded to the steel columns. The same procedure was followed for the second floor slabs. Mr. Lemcoe concluded that this method is economical for bays of 24 ft. or over because installation of service facilities and placing of concrete are handled at ground level. He also pointed out that the use of prestressing permitted larger bays and thinner slabs, which resulted in fewer columns and lower height of building, than with conventional construction methods.

A laboratory investigation of the characteristics of expanded shale aggregate was reviewed by R. W. Schafer, Texas Highway Department. As standard methods of designing mixes were found unworkable due to results not being uniform, it was decided to rely on trial batches producing the desired workability; this latter procedure proved satisfactory. Purposeful air entrainment was found desirable as aiding workability. Six-sack cement with the lightweight aggregate gave compressive and flexural strengths comparable to five-sack concrete with heavy aggregate.

Prof. Phil M. Ferguson briefed a report on bar spacing by Professors R. D. Turpin, J. N. Thompson and himself, all of the University of Texas. Pull-out tests on ¾-in. bars spaced at one to nine diameters were made with blocks designed to eliminate the eccentricity which has occurred in some pull-out procedures. The test results were similar to the recommendations of the A.C.I. Building Code for narrow spacing, but were below the Code for wide spacing.

Fig. 1: Example of a temporary plant set up to pour 1500 cu. yd. for highway structures

**Second and final article describes portable ready-mixed concrete plants which are coming into increasing use on public works and isolated private construction jobs**

By HORACE K. CHURCH*

# SMALL READY-MIX CONCRETE PLANTS

THE USE OF small mobile portable ready-mixed concrete plants on public works and private construction is steadily increasing, particularly where permanently located ready-mixed concrete companies are not available and where pours are scattered and it is not convenient to stockpile materials at each pour. Typical examples of this type of plant are given in the following seven examples. As in the previous cases of seven permanently located plants, the same uniform procedure for figuring production and costs is followed.

Fig. 1 shows a temporary plant which is pouring about 1500 cu. yd. of concrete for highway structures. The work is intermittent, typical of this construction. Hauls average about 2 miles so that two 3-cu. yd. truck mixers are ample for pouring schedule requirements.

Equipment includes weigh batch loader, conveyor, two 3-cu. yd. truck mixers, water storage tank and pump, water truck, and a sack-cement, flat-bed truck. While the plant batching-loading cycle is 9 min., the truck mixer capacity is about 4 cu. yd. each or 8 cu. yd. total hourly, and costs are based thereon.

## Example 1

Production

| | |
|---|---|
| 1. Batching cycle for 3 cu. yd. of concrete | 9 Min. |
| 2. 3-cu. yd. loads per 40 min. hour | 4.4 Lds. |
| 3. Cubic yards of concrete hourly, based on batching time | 13.2 Cu. yd. |
| 4. Cubic yards of concrete hourly, based on average truck mixer capacity | 8.0 Cu. yd. |

Hourly Cost of Ownership and Operation and Labor

| | Own. & Opr. | Labor |
|---|---|---|
| 1. Bulkheads, platform, etc. at $1000 cost, estimated at $200 annually | $0.10 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Conveyor and water system at $3000 | .90 | |
| 4. Tanker truck and flat rack truck at $5000 | 2.00 | |
| Plant man and helpers | | $6.06 |
| 5. Two 3-cu. yd. truck mixers at $13,000 | 5.20 | |
| Drivers | | 3.86 |
| Totals | 11.40 | 9.92 |
| Grand total | | $21.32 |
| Approximate plant, utility trucks, and truck mixer investment | | $30,000 |
| Total crew | | 5 |
| Estimated average daily production, based on average two truck mixer capacity, cu. yd. | | 64 |
| Unit cost, based on all fixed and operating expenses, 64 cu. yd. daily | | $2.67 |
| Move in and out, estimated at $500 prorated over 1500 cu. yd. | | .33 |
| Total | | $3.00 |

This mobile plant requires only two days for takedown and erection, and it has been used on several public works jobs during the past few years.

Fig. 2 illustrates a plant using bulk cement for a waterway job, consisting of canals and inverted siphons, located in a remote mountain area some 55 miles from the nearest available ready-mixed concrete plant. Materials are secured locally from an adjacent mountain stream bed, and are then placed in ground storage to be batched out by the weigh batch loader. Equipment includes weigh batch loader, water system from the stream, conveyor, 250-bbl. cement silo, and two 3-cu. yd. truck mixers. Hauls average about 2 miles, the country being pretty rough and the roads being ordinary, none-too-good construction access roads.

## Example 2

Production

| | |
|---|---|
| 1. Batching cycle for 3 cu. yd. of concrete | 8 Min. |
| 2. 3-cu. yd. loads per 40 min. hour | 5.0 Lds. |
| 3. Cubic yards of concrete hourly, based on batching time | 15.0 Cu. yd. |
| 4. Cubic yards of concrete hourly, based on average two truck mixer capacity | 9.0 Cu. yd. |

Hourly Cost of Ownership and Operation and Labor

| | Own. & Opr. | Labor |
|---|---|---|
| 1. Sheds at $1000 cost, estimated at $200 annually | $0.10 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Conveyor, cement silo, and water syatem at $10,500 | 3.15 | |
| Plant man | | $2.20 |
| 4. Two 3-cu. yd. truck mixers at $13,000 | 5.20 | |
| Drivers | | 3.86 |
| Totals | 11.65 | 6.06 |
| Grand total | | $17.71 |

Fig. 2: Another example of a temporary ready-mixed concrete plant set up for waterway job. It has a silo for bulk cement

*Civil Engineer, Willard Concrete Machinery Sales Co., Lynwood, Calif.

| | |
|---|---|
| Approximate plant and truck mixer investment | $32,500 |
| Total crew | 3 |
| Estimated average daily production, based on average two truck mixer capacity, cu. yd. | 72 |
| Unit cost, based on all fixed and operating expenses, 72 cu. yd. daily | $1.96 |
| Move in and out, estimated at $1500 prorated over 6000 cu. yd. | .25 |
| Total | 2.21 |

There is always a question concerning the worth of a cement silo on a small to medium size construction job, as it involves about $8000 additional investment, but of course eliminates a cement handler when compared to the use of sack cement. Additionally, bulk cement is cheaper than sack cement. If we assume on this particular job that daily production averages 72 cu. yd., that a cement handler would cost $13.20 daily, that the saving on cement would be $0.50 per cu. yd., that ownership and operation expense on the silos is $19.20 daily, and that movein and moveout expense on the silo is $750, then the number of cubic yards of concrete necessary for justifying a silo is given by "N" in the equation:

a. Total cost by silo cement equals total cost by sack cement.

b. $N\left(\frac{\$19.20}{72}\right) + \$750$ equals $N\left(\frac{\$13.20}{72} + \$0.50\right)$

$N$ equals 1800 cu. yd.

This solution for 1800 cu. yd. seems to be in line with opinion; that a job of more than 2000 cu. yd. calls for consideration of the use of bulk cement.

Fig. 3 illustrates a plant setup for a housing project job which involves ground storage of aggregates and the use of bulk cement by a unique and inexpensive system. Cement, delivered by bulk motor carrier, is transferred to three 75-bbl. storage hoppers by means of a 12-in. spiral conveyor, cart-mounted and gasoline-engine driven. Cement is then batched out for 3-cu. yd. mixers into the central compartment of the weigh batch loader. The batching cycle continues with the pickup of aggregates from stockpiles and the belt loading of the 3-cu. yd. truck mixers.

The entire batching and loading operation requires about 8 min. The plant is located on the site and only two truck mixers are required for the 1500 cu. yd. Prior to handling this housing project, the same setup was used on a comparable housing project some 200 miles away.

Fig. 4: Temprorary ready mix plant with 250-bbl. cement silo, weigh batch loader, and two 3-cu. yd. truck mixers

## Example 3

Production

| | | |
|---|---|---|
| 1. | Batching cycle for 3 cu. yd. of concrete | 8 Min. |
| 2. | 3-cu. yd. loads per 40 min. hour | 5.0 Lds. |
| 3. | Cubic yards of concrete hourly, based on batching time | 15.0 Cu. yd. |
| 4. | Cubic yards of concrete hourly, based on average job capacity | 9.0 Cu. yd. |

Hourly Cost of Ownership and Operation and Labor

| | | Own. & Opr. | Labor |
|---|---|---|---|
| 1. | Weigh batch loader at $8000 | 3.20 | |
| 2. | Spiral conveyor for cement at $3500 | 1.05 | |
| 3. | Conveyor, cement hoppers, and water system at $3500 | 1.05 | |
| | Plant [illegible] and helper | | $4.13 |
| 4. | Two [illegible] yd. truck mixers at $13,000 | 5.20 | |
| | Drivers | | 3.86 |
| | Totals | 10.50 | 7.99 |
| | Grand total | | $18.49 |
| | Approximate plant and truck mixer investment | | $28,000 |
| | Total crew | | 4 |
| | Estimated average daily production, based on average job requirements, cu. yd. | | 72 |
| | Unit cost, based on all fixed and operating expenses, 72 cu. yd. daily | | $2.06 |
| | Move in and out, estimated at $500 prorated over 1500 cu. yd. | | .33 |
| | Total | | 2.39 |

Fig. 4 shows a temporary plant for construction job. It features the use of a 250-bbl. capacity cement silo on a 1500-cu. yd. pour for highway structures. The first example, Fig. 1, using sack cement, is located on the same series of three highway jobs, and therefore Figs. 1 to 4 provide an interesting study of the two methods for handling cement on two practically identical jobs.

Equipment includes weigh batch loader, 250-bbl. silo, receiving hopper, water storage tank and pump, water truck, and two 3-cu. yd. truck mixers.

Fig. 2-A: One of the pours for foundation of huge inverted siphons, the pipe for which was poured on the site. Alternate freezing and thawing at high altitude complicated deliveries by truck mixers

Fig. 3: Batching cement prior to batching of aggregates at housing project. Two mixer trucks handled 1500 cu. yd.

Fig. 5: Side-hill set up in oil field where concrete is furnished for mats and foundations

**Fig. 6: Plant serving hospital construction job. Equipment includes weigh batch loader, conveyor, gravity water system, and three truck mixers**

## Example 4

| Production | |
|---|---|
| 1. Batching cycle for 3 cu. yd. of concrete | 7 Min. |
| 2. 3-cu. yd. loads per 40 min. hour | 5.7 Lds. |
| 3. Cubic yards of concrete hourly, based on batching time | 17.1 Cu. yd. |
| 4. Cubic yards of concrete hourly, based on job demands | 8 Cu. yd. |

| Hourly Cost of Ownership and Operation and Labor | Own. & Opr. | Labor |
|---|---|---|
| 1. Sheds and bulkheads at $2000 cost, estimated at $400 annually | $0.20 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Conveyor, water system, hopper, and silo at $11,000 | 3.30 | |
| Plant man | | $2.20 |
| 4. Tanker truck at $2500 | 1.00 | |
| Helper | | 1.93 |
| 5. Two 3-cu. yd. truck mixers at $13,000 | 5.20 | |
| Drivers | | 3.86 |
| Totals | 12.90 | 7.99 |
| Grand total | | $20.89 |
| Approximate plant and truck mixer investment | | $36,500 |
| Total crew | | 4 |
| Estimated average daily production, based on average job demands, cu. yd. | | 64 |
| Unit cost, based on all fixed and operating expenses, 64 cu. yd. daily | | $2.61 |
| Move in and move out, estimated at $1000 prorated over 1500 cu. yd. | | .67 |
| Total | | $3.28 |

The aforementioned comparisons between Example 1 and Example 4 are tabulated:

| | Example 1 | Example 4 |
|---|---|---|
| Job conditions and job yardages | Same | Same |
| Machinery, excepting silo | Same | Same |
| Method for handling cement | Sack | Bulk |
| Approximate plant and mixer truck investment | $30,000 | $36,500 |
| Unit cost, based on the 40 min. working hour or 67 percent plant efficiency, per cu. yd. | $1.94 | $1.89 |
| Unit cost, based on average job demands for concrete, identical demands | $3.00 | $3.28 |

From the above summary and from the observations about bulk cement silo operation in Example 2, we are justified in concluding generally that:

1. A construction pour of less than 1500 cu. yd. does not justify the use of bulk cement unless plant production can be kept up above about 75 cu. yd. daily.
2. Movein and moveout expenses with silo operation tend to be high, and they must be kept below about 40¢ per cu. yd. of concrete prorated, else this item of unit cost will more than negate the operational and economical advantages of silo cement.
3. The owner of a cement silo must keep the unit busy during the amortization period, else depreciation and obsolescence may negate savings on the jobs.

A little side-hill setup in the midst of a booming oilfield where concrete is furnished chiefly for mats and foundations is illustrated in Fig. 5. Such a setup, using gravity rather than power, is ideal for any material handling problem, big or little. Hauls vary from 1 to about 15 miles, and three 2-cu. yd. truck mixers are used generally to capacity. Total machinery includes only weigh batch loader, water system, and truck mixers.

## Example 5

| Production | |
|---|---|
| 1. Batching cycle for 3 cu. yd. of concrete | 12 Min. |
| 2. 3-cu. yd. loads per 40 min. hour | 3.3 Lds. |
| 3. Cubic yards of concrete hourly based on 67 percent plant efficiency | 10 Cu. yd. |

| Hourly Cost of Ownership and Operation and Labor | Own. & Opr. | Labor |
|---|---|---|
| 1. Platform and bulkheads at $1000 cost, estimated at $200 annually | $0.10 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Water system at $300 | .09 | |
| Plant man and helper | | $4.13 |
| 4. Three 3-cu. yd. truck mixers at $19,500 | 7.80 | |
| Drivers | | 5.79 |
| Totals | 11.19 | 9.92 |
| Grand total | | $21.11 |
| Approximate plant and truck mixer investment | | $28,800 |
| Total crew | | 5 |
| Estimated average daily production, cu. yd. | | 80 |
| Unit cost, based on all fixed and operating expenses, 80 cu. yd. daily | | $2.11 |
| Move in and out, estimated at $500 prorated over 5000 cu. yd. | | .10 |
| Total | | $2.21 |

A hospital construction job far removed from permanent ready mixed concrete plants is served by a portable outfit, Fig. 6. The contractor prepared an excellent setup with a concrete apron for ground storage and pickup of aggregates. The plant being on the site, the haul is quite short, averaging about a mile, and the job yardage is about 3000. Machinery includes weigh batch loader, conveyor, gravity water system, and three 3-cu. yd. truck mixers.

## Example 6

| Production | |
|---|---|
| 1. Batching cycle for 3 cu. yd. of concrete | 10 Min. |
| 2. 3-cu. yd. loads per 40-min. hour | 4.0 Lds. |
| 3. Cubic yards of concrete hourly, based on 67 percent plant efficiency | 12.0 Cu. yd. |
| 4. Cubic yards of concrete hourly based on job demands | 9.0 Cu. yd. |

| Hourly Cost of Ownership and Operation and Labor | Own. & Opr. | Labor |
|---|---|---|
| 1. Platform and bulkheads at $1000 cost, estimated at $200 annually | $0.10 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Conveyor and water system at $2500 | .75 | |
| Plant man and helper | | $4.13 |
| 4. Three 3-cu. yd. truck mixers at $19,500 | 7.80 | |
| Drivers | | 5.79 |
| Totals | 11.85 | 9.92 |
| Grand total | | $21.77 |
| Approximate plant and truck mixer investment | | $31,000 |
| Total crew | | 5 |
| Estimated average daily production, cu. yd. | | 72 |
| Unit cost, based on all fixed and operating expenses, 72 cu. yd. daily | | $2.42 |
| Move in and out, estimated at $750 prorated over 3000 cu. yd. | | .25 |
| Total | | $2.67 |

Costs on this job are affected greatly by slow-foundation pouring and by fluctuations in daily demands. Plant crew of two men tends to take it easy because of this condition.

Fig. 7 shows a setup for highway

(Continued on page 190)

**Fig. 7: Aggregates are handled from ground storage at this plant. Screw conveyor moves cement into weigh hopper over mixer**

MEMBER N.R.M.C.A.

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# COMMENT
## from the BUTLER ENGINEER

### . . . . of Planning Ahead of Your Market

A man called at Butler Bin not long ago. Told the switchboard gal (her name's Jane, if you want to know) that he wanted to see me.

Said Jane, "May I have your name, sir?"

He replied, "Just tell him I'm the only contractor over 21 *not* bidding on the Ohio Turnpike."

•

As the Butler Engineer I work on small jobs, big jobs, complex and difficult jobs, but the most difficult job I have is to get our customers to let me plan their Ready Mixed Concrete Plants—*not* for the next fifteen minutes but for the next fifteen years.

Since costs for erection, housing, piping and wiring are almost the same for a small Plant as they are for a large one, the actual additional money spent for a somewhat larger bin and more capacity in the elevator and the batching equipment is small indeed when compared with the cost of the fleet that carries the concrete. And, less expensive to plan adequately now than to add capacity later.

As you know, it's the efficient and quick dispatch of trucks through the Plant that spells the difference between nuts or nuggets of gold.

So after determining what is now required for your present market, plan ahead *now* for expansion. The extra money involved is small, efficiency is generally increased and your investment is protected for the future.

Think BIG enough and PLAN big enough with

*The Butler Engineer*

BUTLER BIN COMPANY

WAUKESHA, WISCONSIN


## Small Portable Plants

*(Continued from page 188)*

structures in desert country, again pretty far from available permanent ready mixed concrete plants, and the yardage is about 2200. Hauls average about 8 miles. The aggregates are handled from ground storage, and a 250-bbl. silo with screw conveyors is used to handle bulk cement. The cement is handled by screw conveyor into a weigh hopper over the foot of the mixer loading conveyor where it is blended with aggregates prior to discharge into the truck mixer. Water is trucked in and then raised to an elevated storage tank.

Equipment includes weigh batch loader, conveyor, cement silo, screw conveyors, cement weighing hopper, pumping system, water truck, and two 4½-cu. yd. truck mixers. The weigh batch loader, having only capacity for 3 cu. yd. of concrete, makes two cycles for the 5-cu. yd. loads of concrete, requiring about 15 min. for the total batching cycle.

### Example 7

Production

| | | |
|---|---|---|
| 1. Batching cycle for 5 cu. yd. of concrete | 15 | Min. |
| 2. 5-cu. yd. loads per 40-min. hour | 2.7 | Lds. |
| 3. Cubic yards of concrete based on 67 percent efficiency | 13.5 | Cu. yd. |
| 4. Cubic yards of concrete daily based on job demands | 10.0 | Cu. yd. |

Hourly Cost of Ownership and Operation and Labor

| | Own. & Opr. | Labor |
|---|---|---|
| 1. Office and bulkheads at $2000 cost, estimated at $400 annually | 0.20 | |
| 2. Weigh batch loader at $8000 | 3.20 | |
| 3. Silo, cement weigh hopper, belt conveyor, screw conveyors, water tank and water system, and water truck, built by contractor and estimated at $13,000 | 3.90 | |
| Plant man and helper | | $4.13 |
| 4. Water truck at $6000 | 2.40 | |
| Driver | | 1.93 |
| 5. Two 4½-cu. yd. truck mixers at $16,000 | 6.40 | |
| Drivers | | 3.86 |
| Totals | 16.10 | 9.92 |
| Grand total | | $26.02 |
| Approximate plant and truck mixer investment | | $45,000 |
| Total crew | | 5 |
| Estimated average daily production, based on job requirements, cu. yd. | | 80 |
| Unit cost, based on all fixed and operating expenses, 80 cu. yd. daily | | $2.60 |
| Move in and out, estimated at $2000 prorated over 2200 cu. yd. | | .91 |
| Total | | $3.51 |

This total estimated unit cost of $3.51 is the highest of the seven estimated unit costs for construction of "on site" ready-mixed concrete plants. Relative inaccessibility of the job accounts in part for this higher cost, and the cost is also influenced by the desire of the contractor to provide a complete precision plant for the satisfaction of the contracting officer.

### Summary of Temporary Plants

| | | |
|---|---|---|
| 1. Average total plant and truck mixer investment | $33,100 | |
| 2. Average number of 3-cu. yd. truck mixers (and two 4½ cu. yd.) | 2.3 | |
| 3. Average total crew | 4.4 | |
| 4. Average batching and mixer loading cycle for 3 cu. yd. of concrete, including cycles for two 5-cu. yd. loads | 9.9 | min. |
| 5. Average 8-hr. daily production, based on either 67 percent plant efficiency or job requirements, whichever is the lower, cu. yd. | 72 | |
| 6. Average hourly cost of ownership and operation of entire setup | $21.00 | |
| 7. Average total unit cost for plant and truck mixer operation per cu. yd. of concrete $2.33 | | |
| Move in and out expense .41 | $ 2.74 | |

### Conclusions

Many of the 14 plants of this article, both permanent and temporary setups, are operated with very little overhead above the total fixed and operating charges and expenses outlined. Indeed, in many cases the proprietor or the partners work as office men, dispatchers, plant men, helpers, and drivers.

The "spread," difference between delivered price of concrete and price of all materials f.o.b. ready-mixed concrete plant, varies between rather wide limits, but $4.00 might represent a fair average figure. Out of this figure, before profits for the small plant, must come all fixed and operating charges and expenses for the complete setup, $2.14 for the permanent plant and $2.74 for the temporary plant mentioned in this article. These overall costs average $2.44 for an average daily production of 76 cu. yd., thus affording a possible ownership-management profit of $1.56 per cu. yd. based on the foregoing assumptions.

These generalities indicate also that the "break even" point of production for these small plants is right at 50 cu. yd. daily. Of course, the young ready-mixed concrete entrepreneur would do well to pick an area of about 10,000 people where ready-mixed concrete is not available and where the "spread" may very well exceed $4.00 per cu. yd.

## Drain Tile Meeting

*(Continued from page 175)*

urement of stability. This experiment is one of long range scope.

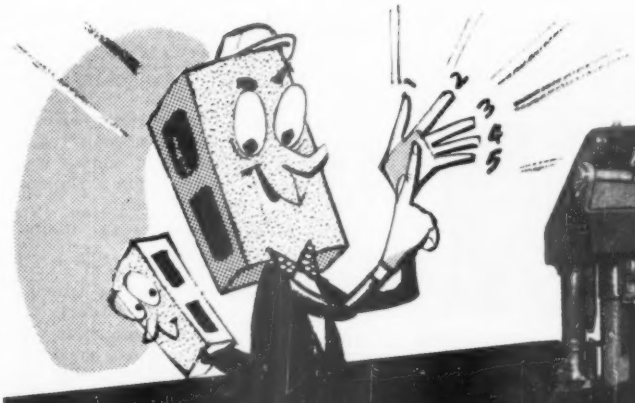
Harold D. Lakin, of the U. S. Soil Conservation Service for Michigan State, spoke briefly on the necessity of the cement tile manufacturers complying with the A.S.T.M. standards and government specifications in their production program.

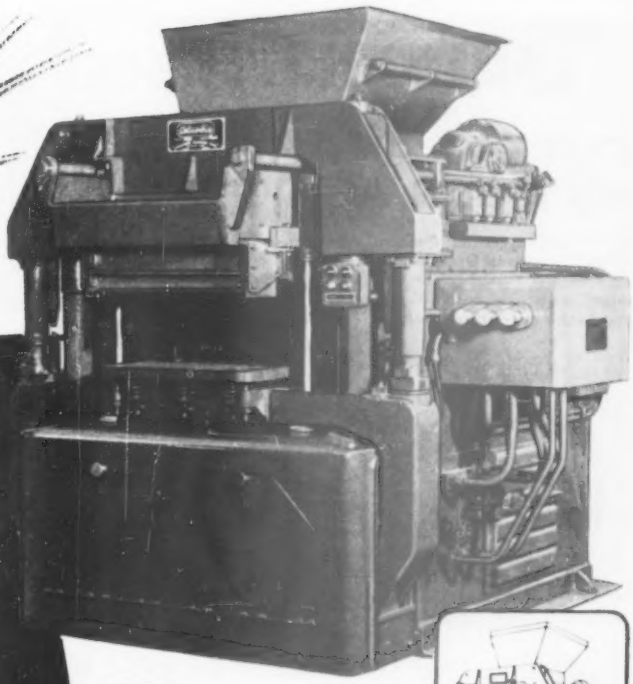
Norman A. Dunn, secretary and treasurer of the company, expressed his company's appreciation of the Michigan Drain Tile Association's attendance at the meeting.

The Concrete Machinery Co. organization consists of W. E. Dunn Manufacturing Co., Masonry Concentrates, Inc., and Colorcrete Industries. All are located in Holland, Mich.

The 1954 annual meeting of the Michigan Drain Tile Association will be held on February 8 at Michigan State College, East Lansing, Mich.

Officers and directors of the association are as follows: David Watkins, president; Lynn Azelton, vice-president; William Stanifer, Terry Hoyle, and Hugh Riehl.





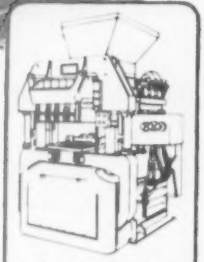
# 5 REASONS FOR Columbia's WORLD-WIDE ACCEPTANCE

1. Highest quality production!
2. Most flexible machine—with half the moving parts!
3. Electronic height control guarantees dense precision block!
4. Amazingly low purchase price!
5. 15-minute mold change!

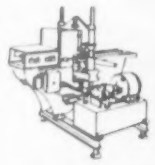
## TOP PERFORMANCE

### WITH COLUMBIA'S 3-BLOCK MODEL 12

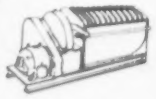
Columbia performance includes fully-automatic, hydraulic operation ... production of 5 to 6 pallets of block per minute ... more production from less floor space—only 96 square feet for this three-block machine ... all moving parts enclosed for easier maintenance and greater safety.



Columbia Model 8, fully-automatic 2-block machine for fast, high-quality controlled block production.



Columbia's semi-automatic or fully automatic block splitter produces fast, clean-cut precision masonry units.



Columbia's batch mixer features a covered gear and V-belt drive, spiral steel blades, rugged construction — 12, 25 and 50 cubic foot sizes.

A few of over 250 types of precision blocks made with Columbia molds.

**Now!** Columbia Block Machines available on lease-purchase or outright sale!

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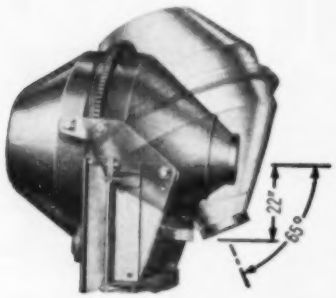
# Burmeister

"TILT-UP" MIXER

## CUTS PLANT HEIGHT AS MUCH AS 8 FEET

Burmeister's patented "tilt-up" feature—which reduces the mixer's headroom requirement—permits lower plant heights. This means easier crane loading, lower power costs, lower initial costs, less costly "conversions," increased portability, and better over-all control.




● In addition to reducing plant height, Burmeister's 3 cu. yd. "Tilt-Up" Mixer (left) provides a steeper 65° discharge from one spot, eliminates segregation of concrete and the danger of accidental discharge. It is simple to install, and has an integral hydraulic system—no compressor is required. Write for name of your nearest Burmeister Distributor, without obligation.

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COMPLETE PLANTS FROM A SINGLE SOURCE

**Burmeister**

L. BURMEISTER CO., 4529 W. MITCHELL ST., MILWAUKEE 14, WISCONSIN


## Central vs. Transit Mix

*(Continued from page 180)*

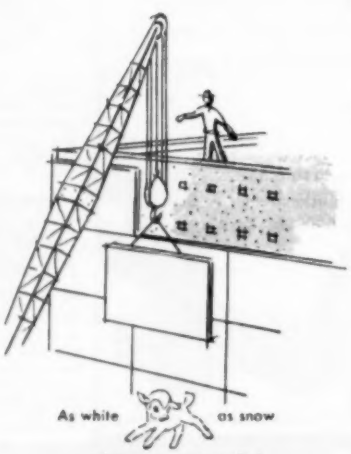
plant, he can eliminate the problem of mix adjustment on the job by producing concrete of the right consistency. On some jobs, it takes a truck mixer operator longer in adding water, to get the desired slump, than it takes to discharge his load.

At a well operated central mixing plant, the chief fault of agitating deliveries has been the loss of slump suffered by the concrete in transit. Even though an attempt is made, at the plant, to properly proportion the mix in order to take into consideration the anticipated loss of slump, the slump loss may be so great that the addition of water at the job may be required. On long hauls, State Highway Departments have reported that as much as one half of the original slump is lost in transit. This would require processing 5 in. slump concrete at the plant in order to deliver 2½-in. slump at the distant job. These figures have not been the rule at our plants. Unless we are plagued with extremely hot cement (over 160 deg.) our slump losses in transit, even on warm, dry days, do not exceed 1½-in.

It is our observation that difficulty in meeting job slump requirements results from failure, at the plant, to provide adequate controls over mixing time, slump, air limits and moisture content of the aggregates. Pro-


the whitest white cement . .

# Trinity White




. . plain or waterproofed

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Some of the most noteworthy architectural structures of this generation are faced with architectural concrete units made with Trinity white cement . . . and Trinity white contributes to the beauty and permanence of many thousands of homes, stores and public buildings. Use Trinity white for terrazzo, stucco and wherever an extra fine appearance is desired.

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vide proper controls and job problems tend to disappear. A necessary part of a control program requires that the mixer operator be correctly informed as to weather factors, length of haul and job conditions. A slump control program will fail if the mixer operator, unknowingly, is using hot cement or hot slag. A central control program cannot succeed if dry, absorptive coarse aggregate (e.g. Florida Coral) is used in the concrete. Such rock should be "wet down" before being used as concrete aggregate. Efficient plants properly prepare materials for use in concrete.

*(To be continued)*

## Concrete Pipe Plant

CONCRETE CONDUIT CO., Colton, Calif., has started operations at its new plant location in Phoenix, Ariz. On a 40-acre tract, the company has erected an office building, plant facilities for the manufacture and steam-curing of concrete pipe, a shop and storeroom building, and storage space for finished pipe. Capacity of the new plant is 3000 ft. of pipe per day. The company produces irrigation pipe, headgates, sewer pipe, storm drains, culverts, and steel-reinforced centrifugal pipe.

The company recently supplied over 7200 ft. of reinforced centrifugal pipe, in sizes from 12 to 66 in. in dia., for the Squaw Peak municipal water system expansion project, and 11,000 ft. of 48- and 60-in. pressure pipe for the Verde River filter plant and supply line.

Plant personnel include W. C. Harford, manager; H. R. Cooper, assistant manager in charge of production; Ted Schmidt, irrigation pipe sales manager; Everett Parks, field superintendent; Carl McPherson, engineer; and Charles Scruggs, office manager.

## Ready-Mix Plant

CAPROCK MATERIALS CO. recently completed an expansion program at its ready-mixed concrete plant at Snyder, Texas. The program included a new office building, a concrete entranceway for the transit-mixer trucks, and a new parking area. The plant has a capacity of about 500 cu. yd. daily, and utilizes more than 24 various types of mobile equipment, including five transit-mixer trucks and a tractor, to serve customers up to 50 miles from Snyder.

## Concrete Products Company

WILLISTON CONCRETE PRODUCTS CO., Williston, N. D., has been sold to F. J. Butler and Associates of Grand Forks, N. D. The former owners, Robert LeSuer, Russel Bartels and Harry Hieb, continue in active management of the business. William Welsh has been appointed business manager. The company, which handles builders supplies, ready-mixed concrete and concrete block, is now operating as Williston Builders Supply Corp.


**FEATURES *Plus*...**
**PERFORMANCE *Plus*...**
***in the New***
**KENTWIN Plain Pallet BLOCK MACHINE**

Among many advanced features are these:

**Push Button Control** with automatic continuous cycling.

**One Masterbox** which permits using low cost interchangeable insert molds.

**Simplified Hydraulic Operation** with direct acting cylinders.

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**Floor Level Installation.**

**Ruggedly Built with Anti-friction** Bearings throughout.

Can be furnished with Automatic Pallet return and electro-magnetic off-bearing hoist.

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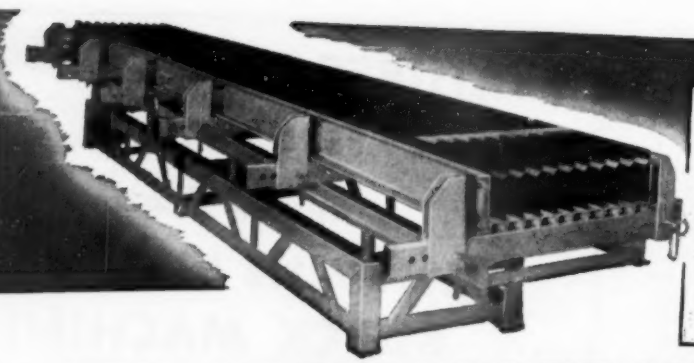

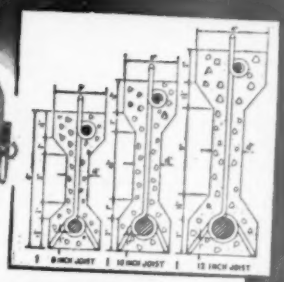

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Cash in on the ever-growing demand for steel-reinforced concrete joists. Your experience and contacts in the building trade should make it easy to build up a profitable business in this new line. Concrete joists are simple to make, have unusual strength, are termite proof. The KIRK & BLUM Type "S" Heavy Duty Vibrating Table is capable of multi-production of concrete joists, allowing a fine profit-margin. Easily produced by unskilled operators. For complete details and prices, write to The Kirk & Blum Mfg. Co., 3210 Forrer Street, Cincinnati 9, Ohio.

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Cavitex is new—in size, proportion, design and color range. Cored-out design provides insulation values and saves weight. Easily the most practicable unit for cavity-type wall construction. Ideal also, as veneer over frame, or as facing over 4" concrete block. Available in pastel tones for exposed masonry interior walls.

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*Many choice locations are open for the local manufacturing of Cavitex. Excellent opportunity for concrete products manufacturers. Each plant operates under franchise in protected territories. Cavitex machine available on lease or sale. If interested, ask for "Opportunity Unlimited."*

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***Concrete* STEPS**

**A Small Investment That Pays Big Dividends**

**Homeward all metal forms are precision built to produce a product that requires no hand finishing.**

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Making quality block is your job. Making sure your block become quality walls is just as important to your success.

That's why most successful producers work with architects and builders to encourage good workmanship. They regularly visit jobs on which their block are being used to see that the principles of quality construction are being observed.

Quality block, plus quality walls and floors, are your best salesmen for future business. Send for a free copy of *"Concrete Masonry Handbook,"* which contains recommended construction practices. It is distributed only in U. S. and Canada.

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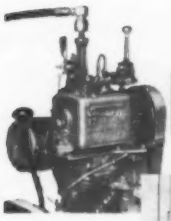

# POWERLIFT

# Now truck-man INCREASES CAPACITY

## FOR REAL BLOCK HANDLING ECONOMY

Designed especially for and tested in Concrete Products Plants—the new Model DHP Heavy Duty Truck-Man with *Power Lift* is ready to start saving money for you. This new Truck-Man will handle a full 72 block rack with ease. (New rated capacity—4500 lbs.) *Power Lift* eliminates the back-breaking, time consuming task of raising the load—a flick of the wrist and it's on the way. Once load is raised from the floor, TAKE OFF—balance of lift can be made in transit. As much as a minute is saved each trip—more trips per day—more work with less effort. Oh, yes—all the regular Truck-Man advantages of the agile standard models are retained.

### FIVE OTHER VERSATILE MODELS

**MODEL DH**—4500 lb. Skid Lift with hand pump

**MODEL DFP**—3000 lb. capacity, power lift Pallet Toter.

**MODEL DF**—Pallet Toter with hand pump (3000 lb. capacity).

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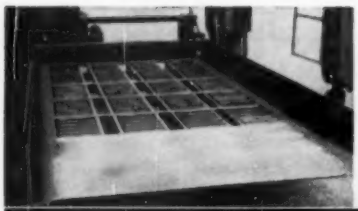
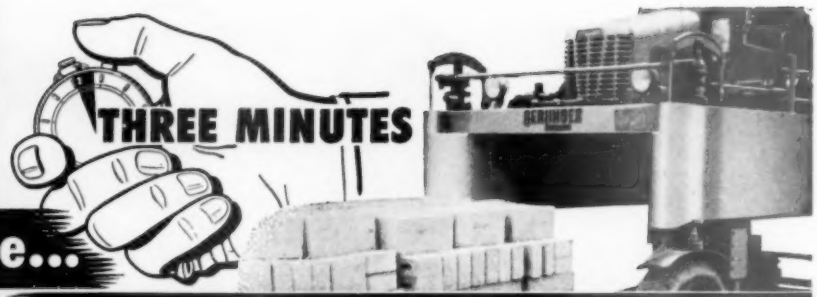
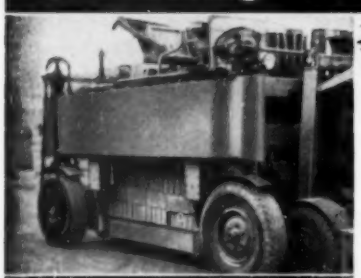





# Unloading Time... with a GERLINGER CARRIER



**Kennedy Concrete Block Co., Philadelphia, was plagued with the same problem that faces most concrete products manufacturers: laborious, time-consuming unloading at customer-selected locations. This firm's solution is a GERLINGER Material Carrier, designed to drop cube loads with no manual labor or use of pallets.**

**The Gerlinger is equipped with a movable holding plate that is held by the carrier's shoes. Cube loads of 400 blocks are placed on the plate by the yard lift truck, and are unloaded at the customer's location by merely dropping the shoes. A push-bar shoves the load off the steel plate. Mr. Garfield Kennedy, president, says: "It takes our Gerlinger driver only three minutes to drop a load. The use of this system has speeded up our deliveries and eliminated expensive manual handling."**

**For complete details, drop us a card. We'll gladly send you our free catalog showing all models of Gerlinger Material Carriers.**

**TOP:** Movable plate equipped with four rows of rollers held in place by the Gerlinger's shoes.

**CENTER:** Cube loads are loaded by yard lift truck.

**BOTTOM:** Push bar mechanism mounted at rear of Gerlingar, powered through a universal connection to the carrier's motor.

GERLINGER CARRIER CO.

G-311

**GERLINGER CARRIER CO., DALLAS, OREGON**

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PENN-DIXIE

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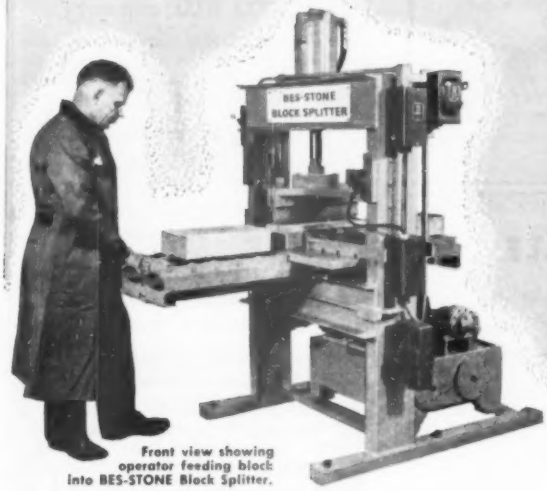
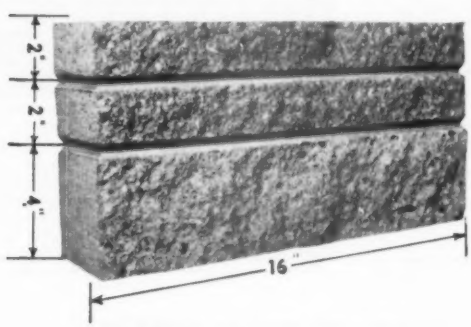
# BES-STONE
## BLOCK SPLITTER




Front view showing operator feeding block into BES-STONE Block Splitter.

- **Operates Automatically**
- **Produces 960 Split Block Per Hour**
- **Easily Adjusted for Various Heights**
- **Splits in a Straight Line — No Culls**
- **Has a Powerful Hydraulic Action**
- **Combines Quiet Operation with Safety**

Here is another Besser machine — the BES-STONE Block Splitter — designed primarily for the Concrete Products Industry. The machine splits block with speed and precision, in a variety of modular sizes. It's fully automatic. The block is placed under the knife automatically . . . the blade descends with a smooth, hydraulic action . . . and the split block is ejected by the incoming block. The operator is always at a safe distance. The BES-STONE Block Splitter enables plant operators to offer additional lines and affords new profit possibilities. Write for Bulletin No. 95A.




**BES-STONE in Modular Sizes**

BES-STONE, the product of the BES-STONE Block Splitter, is a new masonry unit with a split-stone appearance, made in many sizes and in a series of attractive, permanent colors. You'll find it complements, and greatly increases your sales of standard stripper block.

# BESSER

***Complete Equipment for Concrete Products Plants***

**BESSER MFG. CO., ALPENA, MICH., U. S. A.**

# GET HIGH EARLY STRENGTH WINTER CONCRETE

## *with Standard Cement plus Solvay Calcium Chloride*

- Provides Additional Cold Weather Protection
- Permits Positive Control at All Temperatures
- Assures High Ultimate Strength
- Avoids the Need for Special Cement
- Includes "Built-in" Curing
- Lowers Your Costs

To speed up operations and permit use of concrete in shorter time—especially in cold weather—add Solvay Calcium Chloride to your Portland Cement concrete mixes. Works equally well with all Portland Cements, including standard, high early, air entrained and low heat cements. It helps lengthen the pouring day and cuts costly protection time in half.

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**APPLEY BLOCK MACHINE**
**(COMPLETE WITH)**

25 metal racks.
1400 (8x8x16) Steel Pallets.
94 Aluminum Pallets.
Double Bull Nose Sash Attachment.
100 Double Bull nose sash Pallets.
Bull Nose Attachment.
300 Bull Nose Pallets.
315 (8x12x16) Foundation Pallets.
Package Price $2500—used, but good condition.

Interested in purchasing used 4 inch Bell-type Concrete Tile Machine.

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**FOR SALE**

One Brand New Kent No. 526 Standard Blockmaker with pneumatic head and eight-inch Mold Box. Write or phone.

**MARBLE FACE BLOCKS**
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War Surplus Bargain
**New — Ready To Use!**
**40,000 BTU capacity**

—Burning gasoline, kerosene or diesel fuel.
—Electric blower—12 V. DC or 110 V. AC using small transformer which we furnish with each heater.

**Portable, Quick, Clean Heat**

Ideal for curing room, concrete plants, work under construction, emergency heat, or auxiliary heaters.

**$95.00 each**

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**FOR SALE**

900—12 inch steel cored pallets.
1700— 8 inch steel cored pallets.
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Practically new. Inquire by phone or letter to—

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**FOR SALE**

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1 used Van-U-Matic 3 block plain steel pallet block machine 8" and 12" mold boxes. Reason for selling—installing larger equipment.

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LOWER COST
**PACKER-HEAD WINGS**
Proved to last as long or longer — yet cost considerably less. Write for prices.
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Dunbrik machine and pallets, as is, $1,000.00 F.O.B. Tifton, Georgia.

TIFTON BRICK & BLOCK CO.

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**FOR SALE**

20 Precast Concrete Channel Roof Slab Forms made of heavy gauge steel 2'0" x 9'0" with adjustable end. Excellent condition. Used once. $45.00 each. F.O.B. Vineland, New Jersey.

**EDWARD CAMPBELL COMPANY**
East Ave. & Walnut Rd.
Vineland, New Jersey

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**STOP that WATER**
With FORMULA NO. 640
A clear liquid—7 different resins in a solvent which penetrates 1" or more into concrete, concrete blocks, stucco; seals, holds 1250 psf water pressure. Applies quickly—no mixing—no furring—no membranes—no cleanup. Use on forms—wood or concrete.
HAYNES PRODUCTS CO., OMAHA 3, NEBR.

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**LARGE DRAIN TILE MACHINE**

Makes all sizes up to 24" dia. in 1 ft., 2 ft. or 2½ ft. length. 25 hp direct drive. Machine for sale or lease. Jackets, etc., for sale or will lease by the day.

**Nashua Tile Co., Nashua, Iowa**

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**"INCREASE YOUR VOLUME WITH CONCRETE BURIAL VAULTS. PAY OFF BIG"**

Air and Top-Sealed adjustable molds, makes four sizes $850., Sectional Box $525. Good used molds half price. Precast garbage bin $425., and barbecue $375. Septic tank $775. Order before prices increase. Shipment within six weeks.

**VAULT FORM MFGS.**
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**FOR SALE**

#9 Joltcrete with dual shaft vibration; power carriage; air-operated off-bearer and elec. height control. Also, 4", 8", 12", 4" solid and chimney blk. mold boxes and steel pallets. Needs no repairs. Reasonable.

**ALBERT J. SMALDONE**
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**CEMENT COLORS**

Write for free samples and prices of "LANSCO" CEMENT COLORS produced in 50 attractive shades. Packed in bulk and in 1 lb. and 5 lb. packages.

*manufactured by*
LANDERS-SEGAL COLOR CO.
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UNBREAKABLE
**PALLET RINGS**
Write for full information
TEXAS FOUNDRIES
LUFKIN, TEXAS

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**CONCRETE BRICK COLORS**
**CEMENT COLORS**
**MORTAR COLORS**
*made by*
**BLUE RIDGE TALC CO., INC.**
Henry, Virginia

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**FOR SALE**

GoCorp Senior block machine complete with 50 cu. ft. mixer, off-bearer, and 4", 6", 8" and 12" molds for 18" block. This machine is presently operating, is equipped with height and density controls. Priced for quick sale. BOX L-79, CONCRETE PRODUCTS, 309 W. Jackson Blvd., Chicago 6, Ill.

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**FOR SALE**

Fully automatic Flemming Block Machine F.M. 108 with two 8" mold boxes, one 6", one 4", one 12". One brick mold 4,000; pallet machine. Value with all boxes $6,000. In good shape, will demonstrate or set up in your plant. Replacing with machine with larger production.

**HARPOLE CONCRETE PRODUCTS**
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**FOR SALE**

2—3 yard Challenge Mixers
1—1949 Model M3-142 ..... $1250.00
1—1950 Model M3-354 ..... $1500.00
Both in excellent condition mechanically, and painted your color.

**HYDRAULIC CONCRETE PRODUCTS**
South 8th Street & 11th Ave.—Phone 6645
COUNCIL BLUFFS, IOWA

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**BUILD GOOD WILL**

Advertising necessities for the block industry. Line Pins, Twigs, Modular Coursing Stick. Also the new Block Calculator and Wood Corner Block. All imprinted with your advertising. Complete catalog on request.

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**WILL RENT AT BARGAIN RATES**

Brand new 5½ c.y.
Rex Hi-Discharge Mixers (1952)
on G.M.C. trucks.
Deliver to any location.

Write or wire Box 295, Evansville, Ind.

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KEEP ABREAST
WITH
INDUSTRY TRENDS
THROUGH
ROCK PRODUCTS



ALSO SEE WHERE TO BUY ADVERTISING ON OTHER EQUIPMENT IN ROCK PRODUCTS' GENERAL SECTION

## WANTED

1—Used 400 Bbl Bulk Cement Bin with Bucket Elevator unloading Screw—Weight Batcher (complete unit).

1—Used 3 Compartment Aggregate Bin—including Weight Batcher single or dual (complete unit) —120 ton or larger. Advise full particulars including location and price.

Contact—W. H. Day

**JACKSON READY-MIX CONCRETE**
P. O. Box 1023
Jackson, Mississippi
Telephone No. 3-1677

## PLANT SUPERINTENDENT WANTED

For Concrete Block Plant located at Miami, Florida. An opportunity for an experienced and well qualified man to take over the management of three block plants. Prefer a man with engineering background. Excellent salary and bonus. Replies confidential. Give complete resume of past experience.

**MAULE INDUSTRIES, INC.**
1760 Purdy Avenue
Miami Beach, Florida

**WANTED: Septic Tanks that need cleaning!**

BIONETIC is a safe, sure, economical method.
Cleans sewage solids from tank.
Eliminates odors.
Cleans tile fields, prevents plugging.
Cleans grease traps.
Harmless to humans and plumbing.

BIONETIC at $4.25 per pound, or case of 12 one pound containers $48.00, 25 pound drum $3.25 per pound.
*Some Dealer and Distributor Franchises open.*
*Advisory Service, write us.*

P. O. Box 6724, Dept. CPM RELIANCE CHEMICALS CORPORATION Houston 5, Texas

**SUPERINTENDENT WANTED**

Full charge superintendent for large midwestern block manufacturer. Experienced competent man, able to handle over 50 man, high production, Besser block plant. Engineering background desirable. Salary open, based on knowledge and ability. Give complete details in first letter. All replies confidential. Principals only.

Box L-99, CONCRETE PRODUCTS, 309 West Jackson Boulevard, Chicago 6, Illinois.

**WANTED**

F.M.C. 180 block machine or its equivalent. In good condition. Reasonable.

**CLEARWATER LAKE CONCRETE BLOCK CO.**
Clearwater Lake, Wis.

**WANTED**

A contractor interested in operation of Perlite Crushing Plant in northwestern Arizona. Must be experienced in crushing and especially screening 1/16" to 1/100" granulation. State experience and what equipment such as diesel-generator set, or other equipment could furnish.

Mail replies to BOX L-98, ROCK PRODUCTS, 309 W. Jackson Boulevard, Chicago 6, Illinois.

# FREE SERVICE for Buyers

Get information and prices quickly on machinery, equipment. Check item (or items) about which you desire information. Send to us.

**Send To:**

**Research Service Department**
**ROCK PRODUCTS**
309 W. Jackson Blvd. Chicago 6, Ill.

___Admixtures, Aggregate
___Aftercoolers, Air
___Agitators
___Aggregates (special)
___Air Compressors
___Air Separators
___Asphalt Mixing Plants
___Bagging Machines
___Bags
___Barges
___Batchers
___Belting, Conveyor, Elevator, Power Transmission
___Belting, V-type
___Belt Repair Equipment
___Bin Level Indicators
___Bins and Batching Equipment
___Bits
___Blasting Supplies
___Block Machines, Concrete Building
___Bodies, Trailer
___Brick Machines and Molds
___Buckets
___Bulk Cement Handling Equipment
___Bulldozers
___Cars, Industrial
___Central Mixing Plants
___Classifiers
___Clutches
___Coal Pulverizing Equipment
___Concentrating Tables
___Concrete Forms
___Concrete Mixers
___Concrete Mixing Plants
___Concrete Specialty Molds
___Concrete Waterproofing and Dampproofing
___Conveyors
___Crushers
___Coolers
___Cranes
___Curing Equipment
___Derricks
___Dewatering Equipment, Sand
___Diesel Engines
___Dragline Cableway Excavators
___Draglines
___Dredge Pumps
___Drilling Accessories
___Drills
___Dryers
___Dump Bodies
___Dust Collecting Equipment & Supplies
___Electric Motors
___Engineering Service, Consulting and Designing
___Explosives & Dynamite
___Fans and Blowers
___Feeders
___Fifth Wheel, Heavy Duty Special
___Flotation Equipment
___Front End Loaders
___Gasoline Engines
___Gear Reducers
___Generator Sets
___Grinding Media
___Gypsum Plant Machinery
___Hard Surfacing Materials
___Hoists
___Hoppers
___Kilns: Rotary, Shaft, Vertical
___Locomotives
___Lubricants
___Magnetic Separators
___Masonry Saws
___Mills
___Pipe
___Pumps
___Scales
___Screen Cloth
___Screens
___Scrubbers: Crushed Stone, Gravel
___Shovels, Power
___Speed Reducers
___Tanks, Storage
___Tires and Tubes
___Torque Converters
___Tractor Shovels
___Tractors
___Trailer Dump Bodies
___Trucks, Bulk Cement
___Trucks, Industrial
___Trucks, Mixer Body
___Trucks, Motor
___Valves
___Vibrators
___Welding and Cutting Equipment
___Winches
___Wire Cloth
___Wire Rope

If equipment you are in market for is not listed above, write it in the space below.

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_____
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Your Name_____ Title_____
Firm Name_____
Street_____
City_____ State_____

CP-12

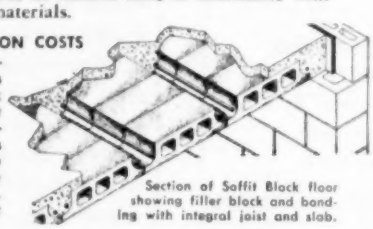
## "I Find BOTH Profitable"

### VIBRAPAC Block and SOFFIT Floor and Roof Filler Block

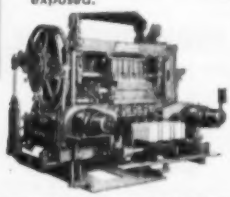
Vibrapac block plants are now adding to their profits by manufacturing Soffit Filler Block for floors and roofs. These units assure permanent, fire-safe construction, at low cost. Soffit Block provide maximum acoustical and insulation values with natural base for radiant heat installations. Made in various sizes to coordinate with other modular materials.

**CUTS CONSTRUCTION COSTS**

Temporary adjustable steel centers support Filler Block while slab and joist are curing. Conventional shoring is eliminated. The smooth, flush surface can be plastered, painted or left exposed.



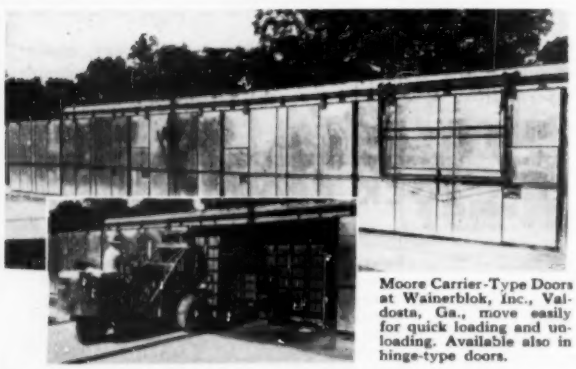
Section of Soffit Block floor showing filler block and bonding with integral joist and slab.



**BESSER VIBRAPAC**

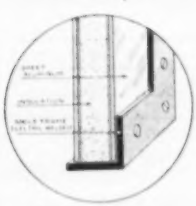
Vibrapac Block for walls, floors and roofs, in all styles and sizes, are made on a Besser Vibrapac, using one set of Plain Pallets. Fully automatic. No machine operator required. Write for descriptive literature.

**BESSER MANUFACTURING CO.**
ALPENA, MICHIGAN, U. S. A.
*Complete Equipment for Concrete Products Plants*



Moore Carrier-Type Doors at Wainerblok, Inc., Valdosta, Ga., move easily for quick loading and unloading. Available also in hinge-type doors.

## Moore Metal-Insulated Kiln Doors Save Fuel—Reduce Curing Time



Keep heat where it belongs—inside the kiln—with Moore Aluminum-Insulated Doors. They improve curing conditions — save steam—last longer.

Send us dimensions of present door openings for quotation.

**MOORE DRY KILN COMPANY**
Oldest and Largest Manufacturers of Lumber and Veneer Dryers
JACKSONVILLE, FLORIDA · BRAMPTON, ONT. CANADA · VANCOUVER, B. C. CANADA · NORTH PORTLAND, OREGON


## INDEX TO ADVERTISERS IN THE CONCRETE PRODUCTS SECTION OF ROCK PRODUCTS

SEE INDEX OF ROCK PRODUCTS SECTION ADVERTISERS ON PAGES 211, 212


| | |
|---|---|
| Bergen Machine & Tool Co., Inc. | 170 |
| Berg Vault Co. | 194 |
| Blue Ridge Talc Co., Inc. | 198 |
| Besser Manufacturing Co. | 197, 200 |
| Blaw-Knox Company | 201 |
| Branch, Marion S., Company | 198 |
| Burkham, Robert, & Co. | 198 |
| Burmeister, L., Co. | 192 |
| Butler Bin Company | 190 |
| Calsi-Crete Corporation | 202 |
| Campbell, Edward, Company | 198 |
| Clapp, Riley & Hall Co. | 198 |
| Clearwater Lake Concrete Block Co. | 199 |
| Columbia Machine Works | 191 |
| Cook Bros. Equipment Company | 189 |
| Dalmo Cement Products Co. | 198 |
| Dunn, W. E., Mfg. Co. | 194 |
| Gerlinger Carrier Co. | 196 |
| Gerson Co. | 198 |
| GoCorp. | 168 |
| Harpole Concrete Products | 198 |
| Haynes Products Co. | 198 |
| Heltzel Steel Form & Iron Co. | 171 |
| Hydraulic Concrete Products | 198 |
| Jackson Ready-Mix Concrete | 199 |
| Kent Machine Company | 193 |
| Kirk & Blum Mfg. Co. | 194 |
| Landers-Segal Color Co. | 198 |
| Lone Star Cement Corporation | 172 |
| Marble Face Blocks | 198 |
| Maule Industries, Inc. | 199 |
| Miller Bros. Concrete Block & Materials | 198 |
| Moore Dry Kiln Company | 200 |
| Nashua Tile Co. | 198 |
| Penn-Dixie Cement Corp. | 196 |
| Portland Cement Association | 195 |
| Reliance Chemicals Corporation | 199 |
| Smaldone, Albert J. | 198 |
| Solvay Process Division, Allied Chemical & Dye Corp. | 197 |
| Texas Foundries | 198 |
| Tifton Brick & Block Co. | 198 |
| Trinity White Div., General Portland Cement Co. | 192 |
| Truck-Man Division | 195 |
| Vault Form Mfrs. | 198 |
| Williams, Roger F. | 194 |

# YOUR ONLY SOURCE FOR THESE "COMPLETE PACKAGE" ADVANTAGES FOR READY-MIX OPERATIONS

## ONE SOURCE RESPONSIBILITY

All your equipment comes from one responsible manufacturer, on one order and in one shipment. In dealing with one source, you can be sure of undivided attention to your problems and interest in the successful performance of your equipment.

## ONE SOURCE FOR SERVICE AND PARTS

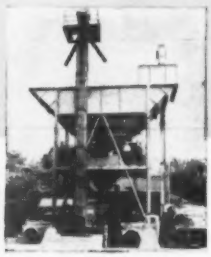
You have a nearby source of replacement parts and prompt, efficient maintenance service from one dependable distributor organization. One Blaw-Knox trained man can service all your equipment, give *preventive* maintenance to your "Complete Blaw-Knox Package".

## ONE SOURCE FOR ALL YOUR EQUIPMENT

The Blaw-Knox "Complete Package" contains every piece of equipment you need for profitable ready-mix operations. Whatever type of work you do, there's a combination of Blaw-Knox equipment in a "package" tailor-made for your requirements and with the flexibility to handle many other applications where the same equipment can be profitably used.

## ONE FINANCIAL ARRANGEMENT

You have just one financial contact, and one financial arrangement covers all your equipment when you buy a one-source "package". Whether you are an established operator, or just entering the profitable ready-mix field, you'll benefit by this convenient "Complete Package" system.

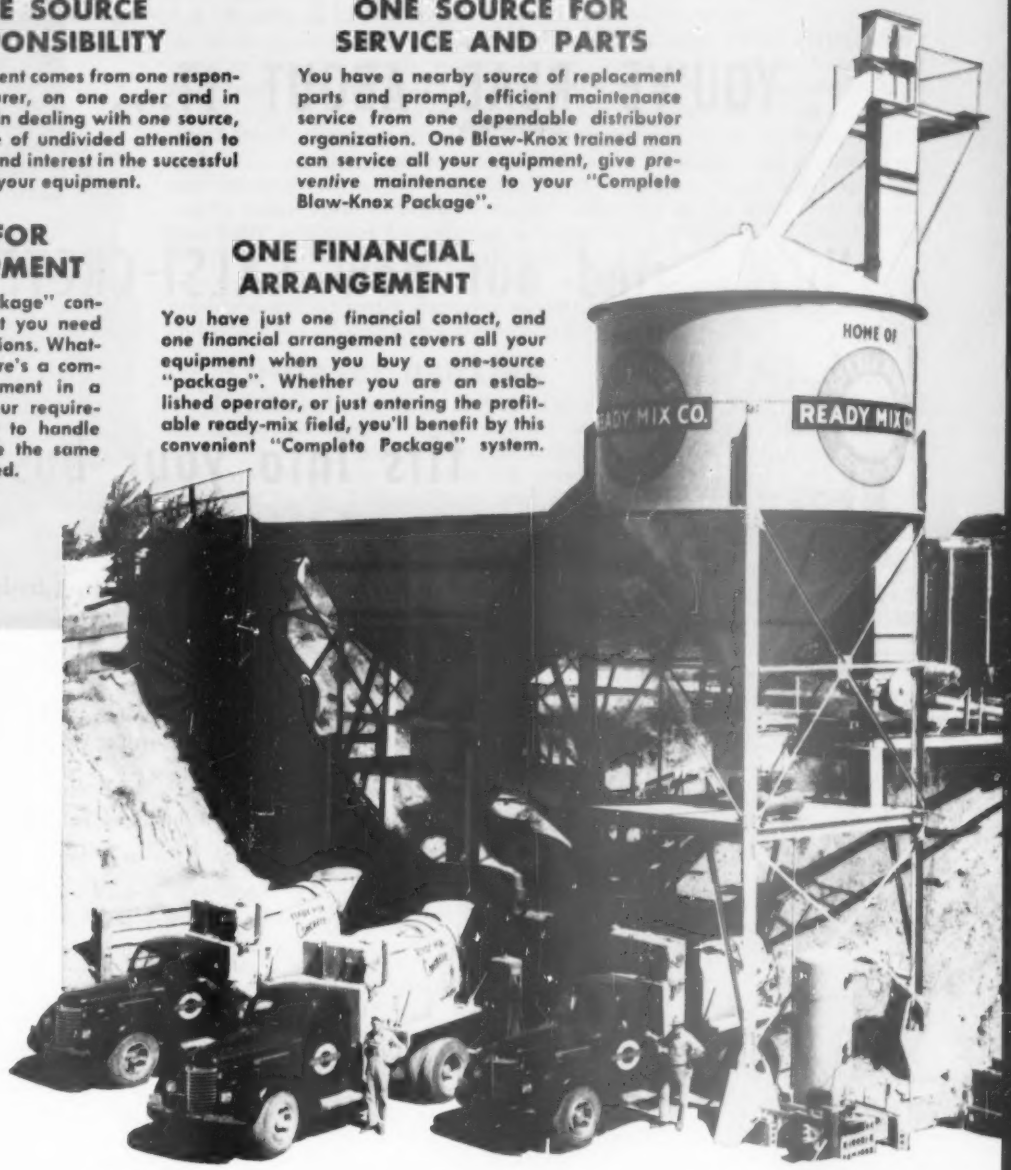


### TRUCK MIXER LOADING PLANTS

Complete one-stop plants for loading truck mixers of all sizes and types with accurately measured quantities of aggregate and cement. Bins may be compartmented to suit your needs.

### CLAMSHELL BUCKETS

Blaw-Knox Clamshell Buckets are available in a wide range of sizes, weights and types for every material handling, hard digging or general purpose requirement.




### AGGREGATE BATCHING PLANTS

For fast, accurate batching. Portable for easy moving. Self-cleaning bins, equipped with automatic, semi-automatic or manual weighing batchers, are available in 2-, 3- and 4-compartment styles, in capacities from 100 to 120 tons.

### HI-BOY TRUKMIXERS

As the lightest-weight heavy-duty complete truck mixer available, the Hi-Boy saves time and money by hauling bigger pay loads at lower cost per yard.

### BULK CEMENT PLANTS

Cut the cost of handling large volumes of cement. Storage bins and weighing batchers can be supplied in any type or style for your requirements. 200- and 400-bbl. sizes available, with combination arrangements which double these capacities.

**BLAW-KNOX**

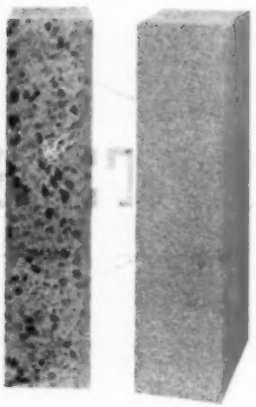
**BLAW-KNOX COMPANY**
BLAW-KNOX EQUIPMENT DIVISION
Farmers Bank Building
PITTSBURGH 22, PA.
Offices in Principal Cities

### GET BLAW-KNOX "COMPLETE PACKAGE" ADVANTAGES

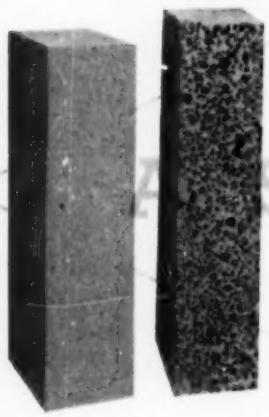
for every concrete highway or airport paving job. The Blaw-Knox "Complete Paving Package" includes Steel Road Forms, Clamshell Buckets, Aggregate and Cement Batching Plants, Subgraders, MultiFoote Concrete Pavers, Spreaders and Finishing Machines. See your Blaw-Knox distributor for details.

# YOU'VE HEARD ABOUT IT...

# YOU'VE READ ABOUT IT...



# NOW...find out how CALSI-CRETE



## fits into your business !

Calsi-Crete, a lightweight load-bearing hydrous calcium silicate, is being acclaimed as the ideal building material based upon years of successful use in Europe. It can be used as load-bearing building blocks, roof planks, insulating roof slabs, cores for firedoors and partitions, and many other applications.

Autoclaved hydrous calcium silicate products made by the Calsi-Crete process offer these outstanding advantages:

1. Light but strong, with high thermal and sound insulation qualities. (K factor for 45 lb. per cu. ft./load-bearing Calsi-Crete is only 1.1 Btu./Ft. $^2$hr. compared with 9.1 for dense concrete.)
2. Stable, durable, fireproof and hygienic.
3. Great resistance to water penetration and frost action because of unicellular structure. Cracking is avoided by negligible wetting and drying movement, least of any known building material.
4. Can be cut, sawed, drilled, chased, screwed and nailed, and provides an excellent key for plastering and rendering.
5. Cost is less than brick, dense concrete or wood in finished construction.
6. Easily made with raw materials abundant in virtually every part of the country.
7. Ease of handling lowers production and utilization costs.
8. For applications where load-bearing is not a factor, Calsi-Crete can be made with 20 lb. per cu. ft. density and a K factor of 0.6.

CALSI-CRETE corporation

321 N. HAMILTON
SAGINAW, MICHIGAN

*Write today! Information on the profitable Calsi-Crete franchise is now available!*

# "ORIENTED DIAMONDS"

## MAKE SPRAGUE & HENWOOD BITS

## CUT FASTER—LAST LONGER

Always a leader in its field, Sprague & Henwood, Inc. PIONEERED the development of ORIENTED Diamond Bits; in which each individual diamond is set with its hardest rib or "vector" toward the work.

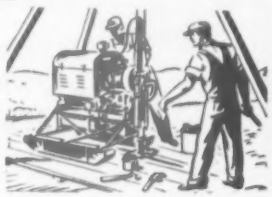
As of the present date we have produced more than FIVE THOUSAND oriented bits, in a wide variety of types and sizes, with both cast and powdered-metal matrices; and have proved, by extensive comparative tests in our own contract drilling operations, that they cut much faster and last much longer than bits in which the diamonds are set at random.

Only selected diamonds of certain crystaline structure can be used and only specially trained and equipped setters of more than usual aptitude can be relied upon to orient diamonds correctly in the mold, but we are now fully organized for efficient production of ORIENTED DIAMOND BITS, at no additional cost to the purchaser.

In terms of footage cost, these are the most economical diamond bits ever produced and we invite inquiries on that basis. Bulletin No. 320 illustrates and describes all types and gives complete data.

### CONTRACT DRILLING

We do drilling by contract and are one of the oldest and largest contractors for any type of core drilling. Experienced crews and supervisors are available for service anywhere in the United States and many other countries. Estimates on request.



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Branch Offices: New York • Philadelphia • Pittsburgh • Grand Junction, Col. • Buchans, Newfoundland



# Why Junk Manganese Castings? They Can Be Repaired

## with MANGA-TONE N.M. and RESISTO-LOY

Note the crack in this large mantle liner. There were three more too.

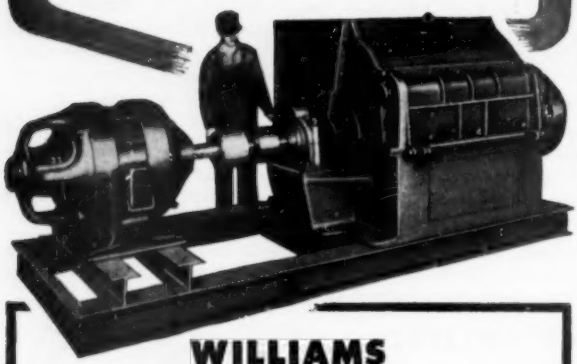
All were properly welded as this one will be also, then the crushing surface was rebuilt to standard size with MANGA-TONE N.M. and a final pass of RESISTO-LOY electrodes was applied over the bottom 20 inches.

This liner then went back into service and has operated daily for almost two years.

Call in our field man for your problems—he is a specialist in this work.

**RESISTO-LOY Co.** *Manufacturers — Grand Rapids 7, Michigan*

# Only One Operation To Crush 6" Stone To Agstone Or Smaller!



## WILLIAMS SECONDARY HAMMER MILLS

For speed and stepped-up output in reducing rock of 6" size to agstone — or down to 20 mesh if required — Williams secondary hammer mills are in a class by themselves! Capacities range up to 75 tons per hour. Hundreds of installations have proved them outstanding profit-makers!

Extremely heavy rib-reinforced construction — manganese steel liners and breaker plates — easy adjustment to compensate for wear — double duty hammers — metal trap for tramp iron — instant access for service — these and many other features make the low cost Williams Hammer Mills top paying investments!

**Many Sizes For Any Requirement**

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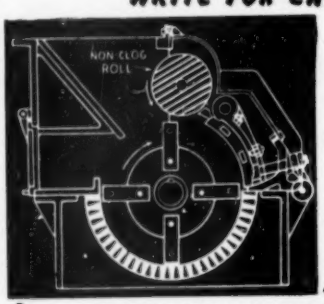



### NON-CLOG ROLL MECHANISM

The best way to handle wet, sticky clay or shale direct from pit for quick grinding without clogging. Roll is attached to hopper opening. Can be driven off main pulverizer shaft if desired.

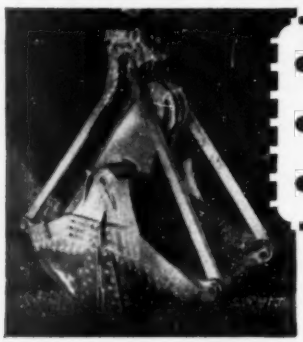
### OTHER WILLIAMS EQUIPMENT

ROLLER AND IMPACT MILLS with Air Separation for grinding to 325 mesh or finer . . . HELIX-SEAL MILLS for dustless or wet grinding . . . DRYER MILLS . . . AIR SEPARATORS . . . VIBRATING SCREENS . . . COMPLETE "PACKAGED" PLANTS ready to install.

**WILLIAMS PATENT CRUSHER & PULVERIZER CO.**
800 ST. LOUIS AVE. ST. LOUIS 6, MO.

**WILLIAMS**
CRUSHERS GRINDERS SHREDDERS
OLDEST AND LARGEST MANUFACTURER OF HAMMER MILLS IN THE WORLD

# BLAW-KNOX *TIGHT LIP* BUCKETS
## DESIGNED FOR HANDLING



- CEMENT CLINKER
- LIMESTONE
- GYPSUM ROCK

For complete information, construction details and specifications . . .
WRITE FOR BULLETIN 2378

BLAW-KNOX Buckets are built especially for low-cost handling of bulk materials in cement plants. Tight fitting lips of cast chrome-nickel-molybdenum alloy steel prevent leakage and resist abrasion to insure long dependable service. Available in a wide selection of capacities and weights to get the most from your crane.

**BLAW-KNOX COMPANY**
BLAW-KNOX EQUIPMENT DIVISION
2035 Farmers Bank Bldg., Pittsburgh 22, Pa.
*Offices in Principal Cities*

**BLAW-KNOX** CLAMSHELL **BUCKETS**
**FOR CEMENT PLANTS**

# ROCK PRODUCTS

HAS THE LARGEST ABC CIRCULATION AND HIGHEST RENEWAL PERCENTAGE IN THE NON-METALLIC MINERALS INDUSTRY

NOW - Authenticated
Drilling Test Results tell
the TRAVEL DRILL story!
Secondary Drilling Costs Cut
to Unbelievable New Low!
Drilling tests comparing Travel Drill performance with experienced jackhammer operators have been carried on in several quarries for well over a year. Test records, kept and authenticated by Travel Drill users, show cost reductions almost beyond belief unless you have seen a Travel Drill in action. Accidents, too, were virtually eliminated. Self-contained and traveling under its own power, a Travel Drill, operated by one man, does the work of 6 to 8 jackhammer operators. Get the Travel Drill facts NOW—
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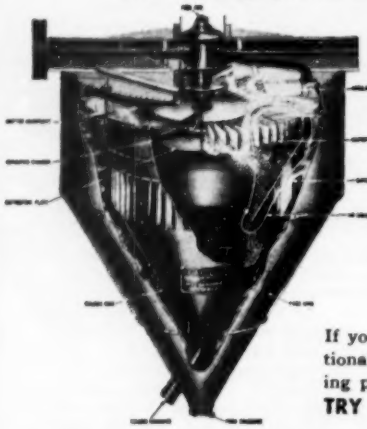

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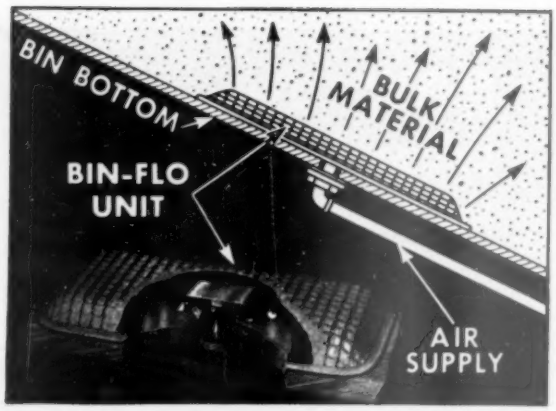


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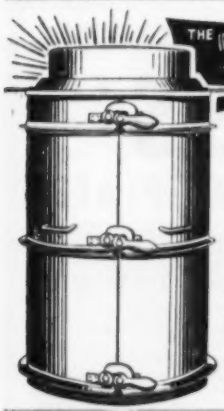

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| 12" | 4 | 1/16" | 1/32" | 28 Oz. |
| 14" | 4 | 1/16" | 1/32" | 28 Oz. |
| 16" | 4 | 1/8" | 1/32" | 28 Oz. |
| 18" | 4 | 1/8" | 1/32" | 28 Oz. |
| 20" | 4 | 1/8" | 1/32" | 28 Oz. |
| 20" | 5 | 1/8" | 1/32" | 28 Oz. |
| 24" | 4 | 1/8" | 1/32" | 28 Oz. |
| 24" | 5 | 1/8" | 1/32" | 28 Oz. |
| 26" | 5 | 1/8" | 1/32" | 28 Oz. |
| 30" | 4 | 1/8" | 1/16" | 32 Oz. |
| 30" | 5 | 1/8" | 1/16" | 32 Oz. |
| 30" | 6 | 1/8" | 1/16" | 32 Oz. |
| 36" | 6 | 1/8" | 1/16" | 32 Oz. |
| 42" | 5 | 1/8" | 1/16" | 32 Oz. |
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| 48" | 8 | 1/8" | 1/16" | 32 Oz. |

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1—NEW 24" XXB Gruendler Shredder or Pulverizer, with 25 H.P. Motor & V-Belt Drive. Cheap.
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### MILLTOWN, INDIANA

2—Vulcan 8' x 125' Rotary Kilns.
1—Raymond #402 Bowl Mill, 40 HP.
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All of the above available for immediate removal. Representative on premises.

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1—Cummer 5' x 40' x 5/6" Rotary Dryer.
1—F. L. Smidth 4' x 30' x 5/6" Rotary Kiln.
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1—Seco 4' x 10' double deck screen.
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1—25 Ton GE Diesel Elec.
1—20 Ton Whitcomb Gas.
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24 x 36 Buchanan Sectional Jaw.
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15 x 36 Farrel B Stat. Plant.
#636 Hydrocone A. Chal. Gyrat.
36" Traylor Ty Gyrat.
30 x 42 Pioneer Portable Primary Secondary.
24 x 36 Diamond Primary Portable Diesel.
10 x 36 Diamond Portable Secondary.
10 x 36 Austin Portable Secondary.
#880 Universal Jr. Gravelmaster
#880 Universal Sr. Gravelmaster.
Telsmith Port. 18 x 32—28" Gyrat.
22 x 36 Cedar Rapids Port. Primary with Diesel.
42 x 48 Traylor Jaw.
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1180 Ft. Chgo. Pneu. Elec.
2800 Ft. Ingersoll Rand Elec.
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300 KW G.E. Mercury Arc Rectifier.
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200 KW G.E. M.G. Set.
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Diamond 40x22 Roll Crusher. Diesel powered.
Cedar Rapids 40x30 Hammermill Twin GMC Diesel.
Jeffrey Flex-Tooth 42x36" hammermill.
Pennsylvania C-4-30 Reversible Hammermill.
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FARREL BACON 36" x 48" Jaw Crusher.
Traylor TY 4' with 200 hp. electric motor.

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Ellicott 12"x10" new pump with new V-12 385 HP Diesel engine. Port. steel hull.
Ellicott 8" with cutter. Diesel Hull 48'x18'x3'6".
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8" H-P twin Diesel drive. Complete.

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NEW F-S 100 ton agg. bin 3 compt.
NEW F-S 400 bbl. cement bin complete.

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Cedar Rapids Portable Super Tandem, excellent.
Pioneer 40-V, New 1946. Portable. Diesel power.
Pioneer WA-300, crushing, washing, screening.
Cedar Rapids AAA Port. Primary crusher 20x36.
Cedar Rapids 40x33 Port. Secondary, Diesel.

**CRUSHERS**

**JAW:** Acme 10x20, 14x36, 14x28, 10x42, 16x32, 18x32, 25x40. Eagle 20x36. Diamond 24x36". Cedar Rapids 10x20, 20x36, 25x40. Farrell 10x20, 13x30, 14x36, 18x36, 36x48. Buchanan 36x42. Good Roads Reliance 15x30. Traylor 18x36, 24x36. Allis-Chalmers 30x18. Good Roads 10x30. Telsmith 18x32. Champion 1030, 1040, 1236, 1530.
**GYRATORY:** Allis-Chalmers-McCully, 6", 7½", 8", 9", 12K, 20", 30", 42", 46", Newhouse, 24", 36". Gyrasphere, 18", 28". Intercone Telsmith, Telsmith 5H, 10-B, 13-B, 16-B. Kennedy Van Saun 7, 19, 25½-8, 37. Traylor Ty 1'8", Ty 2'4". T-4½".
**ROLL:** Cedar Rapids 40x20. Diamond 40x22. Pioneer 30x18. Telsmith 24x16. Pioneer 30"x18". New Holland 24x16.
**HAMMERMILL:** Size 4 Williams Jumbo, Pennsylvania 8X2, 22x22. Cedar Rapids 20x33. Jeffrey 36x42, Jeffrey 36x24, 36x40.
**BALL MILL:** Hardinge 10'x48", K.V.S. 6'x8' Type M Air Swept J-H 6'x6', Hardinge Conical 6'x22". Colorado Iron Works 5'x6'; Marcy No. 64½. Hardinge conical 10'x36".
**ROD MILL:** March 2'x6', 3'x6'. Allis-Chalmers 4'x8', Hardinge No. R 206. Marcy 8'x12'. Hardinge 8'x22".
**CONE:** Symons 2' coarse bowl, 3' standard head.
**TUBE MILL:** Smidth 5½x20, K.V.S. 4'x7', Traylor 5'x22'.
**DRIERS:** Struthers-Wells 7'x64'; others 7'x20', 6'x80', 7'x70', 6'x40' and Cedar Rapids 60"x24'.

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P&H 955 ALC Crane 2½ yds. 130' bm. 1951.
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Northwest 80-D Shovel-Drag. New 1948. Excellent.
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Barber-Greene Plant 848 Mixer, 836 Dryer Diesel.
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Monotrol complete plant. Three years old.

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Special bins to your specifications.
Conveyors—18"—24"—30"—36". Also belt.
24" dia. x 30" face magnetic pulley.

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MILLS: Hardinge 5'x5", 6'x22", 6'x3' and 8'x4'. Kennedy 4x8, 5x6, 5x11. Marcy 4x5, 6x6, 7x16. Raymonds, Sturtevants and others.
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Repair parts for elevators and drives.
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180 roller bearing flat idlers, 5"x20".
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Vibrating feeders with controllers. Jeffrey No. 2A.
2 Westinghouse 1 hp. vibrators 3500 rpm.
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New and used conveyor belt.
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Jaw Crusher & Feeder

20" x 36" Cedarapids Roller Bearings.

3' x 8" Cedarapids Apron Feeder chain drive from crusher with large steel hopper mounted on steel supports.

Excellent Condition.

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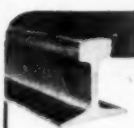

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## INDEX TO WHERE TO BUY


Albert Pipe Supply Co., Inc. 209
Allen, James B. 210

Bacon-Pietsch Co., Inc. 210
Berkwit, J. C., & Company 209
Blue Rock, Incorporated 208
Bonded Scale & Machine Co. 209
Boyle, C. Morris, Blasting Service 210
Brill Equipment Company 207
Buyers, A. & J., Inc. 210

Carlyle Rubber Co., Inc. 207
Chemical & Process Machinery Corp. 208
Contractors Trading & Equipment Corp. 209

Darien Corporation 207
Diaz, Ignacio Gonzalez 211

Everist, L. G., Inc. 209

Foster, L. B., Co. 208
Frank, M. K. 208

Hall, W. K. 209
Harrisonburg Block Company, Inc. 210
Hawkins & Company 211
Heat & Power Co., Inc. 209
Heidenreich, E. Lee, Jr. 208
Heineken, W. P., Inc. 209

Illinois Minerals Company 208

Johnson & Hoehler, Inc. 207

Kelley Island Lime & Transport Co. 210

Maule Industries, Inc. 210
McClarin Plastics 210
McHugh Sand & Gravel 210
McLeod, Alex T. 208
Michigan Silica Company 209
Mid-Continent Equipment Co., Inc. 209
Mississippi Valley Equipment Co. 210

Neal Gravel Company 210
Nussbuam, V. M., & Co. 208

O'Neill, A. J. 210

Pennsylvania Drilling Company 210
Phillips, W. E., Equipment 210
Power Equipment Company 208

Riggle, George 208

Schaefer, Norm 211
Sherrard High School 210
Smith, L. B., Inc. 208

Terteling, J. A., & Sons, Inc. 209
Thomas, Fred E. 211
Tractor & Equipment Company 209
Troyer, Stanley B. 209

Unverzagt, G. A., & Sons, Inc. 208

Virginia Coal & Supply Co. 210

Walsh, Richard P., Co. 207
Weiss, B. M., Co. 208

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*Use the Feedoweight*

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Passaic, New Jersey



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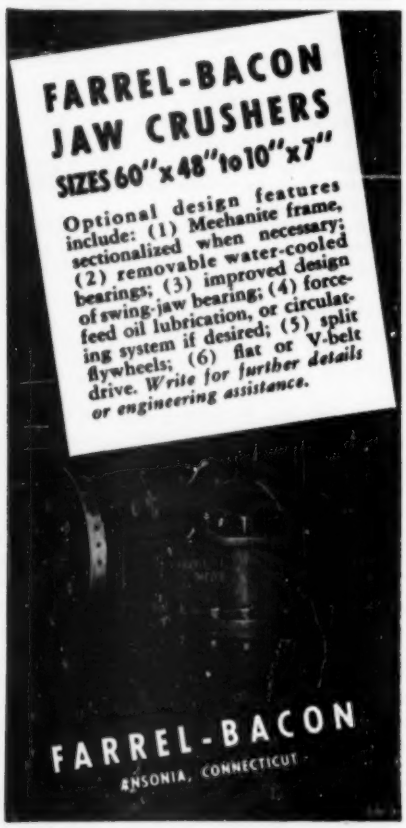
**SIZES 60"x48" to 10"x7"**

Optional design features include: (1) Mechanite frame, sectionalized when necessary; (2) removable water-cooled bearings; (3) improved design of swing-jaw bearing; (4) force-feed oil lubrication, or circulating system if desired; (5) split flywheels; (6) flat or V-belt drive. *Write for further details or engineering assistance.*



**FARREL-BACON**
ANSONIA, CONNECTICUT


# INDEX TO DISPLAY ADVERTISERS


Allis-Chalmers Mfg. Co. .....35, 63, 132
Allis-Chalmers Tractor Division ..... 76
American Brake Shoe Company
American Manganese Steel Division .... 22
Brake Shoe and Castings Division ..... 34
Electro-Alloys Division ..... 10
American Forge Company .....158
American Pulverizer Company .....148
American Steel & Wire Division .....38, 39
Anaconda Wire & Cable Company ..... 72
Atlas Powder Company ..... 25

Babcock & Wilcox Company ..... 71
Baker-Lull Corporation .....129
Baldwin-Lima-Hamilton Corp. ..... 78
Baltimore & Ohio Railroad ..... 8
Barber-Greene Company .....16, 17
Bemis Bro. Bag Co. ..... 33
Bergen Machine & Tool Co., Inc. .....170
Berg Vault Co. .....194
Besser Manufacturing Co. .....197, 200
Bin-Dicator Co. .....206
Blaw-Knox Company .....201, 204
Bradley Pulverizer Co. .....152
Bucyrus-Erie Company .....50, 51
Buell Engineering Co. ..... 27
Burmeister, L., Co. .....192
Butler Bin Company .....190

Calsi-Crete Corporation .....202
Cape Ann Anchor & Forge Co. .....154
Carrier Conveyor Corporation .....127
Caterpillar Tractor Co. 11, Inside Front Cover
Inside Back Cover
Chain Belt Company .....218
Chase Bag Company ..... 60
Chevrolet Motor Division ..... 62
Chicago Steel Foundry Co. .....162
Colorado Fuel and Iron Corporation .....138
Columbia-Geneva Steel Div. .....38, 39, 41
Columbia Machine Works .....191
Combustion Engineering, Inc. .....58, 59
Cook Bros. Equipment Company .....189
Cross Engineering Company .....205

Dempster Brothers ..... 40
Detroit Diesel Engine Division ..... 65
Diamond Iron Works, Co. ..... 56
Dodge Manufacturing Corporation ..... 48
Dorr Company ..... 46
Dunn, W. E., Mfg. Co. .....194
du Pont de Nemours, E. I., & Co., Inc. ..... 52

Eagle Iron Works ..... 74
Easton Car & Construction Company ..... 3
Ensign-Bickford Company ..... 47
Erie Steel Construction Company .....161
Euclid Road Machinery Co. ..... 43

Farrel-Bacon .....212
Foxboro Company .....152
Fuller Company ..... 30

Galigher Company .....154
Gardner-Denver Company .....163
Gates Rubber Company ..... 23
General Electric Company .....155
General Refractories Company .....159
General Motors Corp. .....62, 65
Gerlinger Carrier Co. .....196
GoCorp. .....168
Goodrich, B. F., Company ..... 1
Goodyear Tire & Rubber Co. .....Back Cover

Hammermills, Inc. ..... 4
Harbison-Walker Refractories Co. ..... 57
Hardinge Company, Incorporated .....140
Harnischfeger Corporation ..... 31
Hayward Company .....206
Heltzel Steel Form & Iron Co. .....171
Hercules Powder Company .....157
Hercules Steel Products Corp. ..... 9
Hetherington & Berner, Inc. .....205

International Harvester Co. .....135
Iowa Manufacturing Company ....18, 19, 164

Jaeger Machine Company .....160
Jones & Laughlin Steel Corp. ..... 53
Jones, W. A. Foundry & Machine Co. ..... 37

Kaiser Aluminum & Chemical Sales, Inc. ..151
Kennedy-Van Saun Manufacturing
& Engineering Corp. .....125
Kensington Steel Co. .....131
Kent Machine Company .....193
Kirk & Blum Mfg. Co. .....194
Koehring Company .....28, 29

Le Roi Company ..... 26
LeTourneau-Westinghouse Company ....14, 15
Link-Belt Company .....165
Link-Belt Speeder Corp. ..... 32
Lone Star Cement Corp. .....172

Manhattan Rubber Div. ..... 49
Marion Power Shovel Co. ..... 61
Merrick Scale Mfg. Co. .....212
Minneapolis-Moline Company .....165
Moore Dry Kiln Company .....200
Murphy Diesel Company .....153

Naylor Pipe Company .....142
Nordberg Manufacturing Co. .....54, 158
Northern Blower Company .....144
Northwest Engineering Co. ..... 5

Owen Bucket Co. .....139

Penn-Dixie Cement Corp. .....196
Pettibone Mulliken Corp. .....4, 20, 21
Plibrico Company .....146
Portland Cement Association .....195

Quinn Wire & Iron Works .....206

Radio Corporation of America .....149
Raybestos-Manhattan, Inc. ..... 49
Raymond Division .....58, 59
Resisto-Loy Company .....203
Ryerson, Joseph T., & Son, Inc. .....164

Sauerman Bros., Inc. .....156
Schield Bantam Company .....141
Screen Equipment Co., Inc. .....143
Sheffield Steel Corp. ..... 44
Simplicity Engineering Company .....147
Sly, W. W., Manufacturing Co. .....150
Smidth, F. L., & Co. .....66, 69
Smith Engineering Works ..... 45
Solvay Process Division
Allied Chemical & Dye Corporation .....197
Sprague & Henwood, Inc. .....203
Standard Metal Mfg. Co. .....162
Stephens-Adamson Mfg. Co. .....166
Sturtevant Mill Company ..... 64

Tennessee Coal & Iron Div. .....38, 39, 41
Thew Shovel Company ..... 55
Three Point Belt Lacing Co. .....156
Torrington Company ..... 36
Travel Drill Co., Inc. .....205
Traylor Engineering &
Manufacturing Co. .....6, 7
Trinity White Div., General
Portland Cement Co. .....192
Truck-Man Division .....195
Twin City Iron & Wire Co. .....206
Tyler, W. S., Company .....160

Union Wire Rope Corp. .....12, 13
Universal Engineering Corp. .....20, 21
Universal Road Machinery Co. .....206
United States Rubber Company ..... 42
United States Steel Corp. .....38, 39, 41

Vulcan Iron Works .....145

Wellman Engineering Company .....166
Western Machinery Company ..... 70
Western Precipitation Corp. .....137
Wickwire Spencer Steel Division .....138
Wilfley, A. R., & Sons, Inc. .....206
Williams Patent Crusher
& Pulverizer Co. .....204
Williams, Roger F. .....194
Winslow Engineering Company ..... 24
Worthington Corporation ..... 82

Yuba Manufacturing Co. .....164

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## *Look up your answer here*

Having trouble with bucket elevator chains? Here's a good way to avoid getting caught with your "plants down." Use the right chain for the job. Not just a Rex Chain BUT the right Rex Chain.

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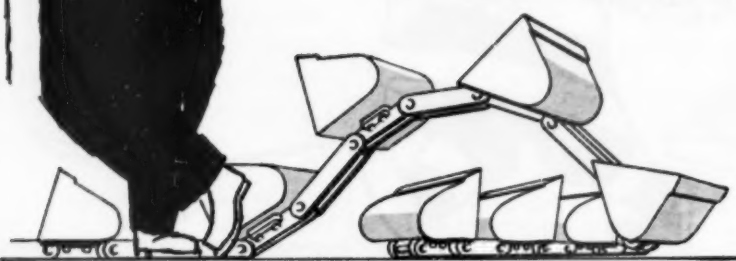
We suggest, too, that you consult your Rex Field Sales Engineer. You'll find he's able to give you a lot of valuable help in chain selection . . . help that will save you plenty.



### CONDENSED CHAIN SPECIFICATIONS

| If You Are Using | And Want a Stronger Chain, We Recommend | Use Same Sprkts. | New Sprkts. Req'd. | Chain No. | Pitch | Working Load | Ultimate Strength |
|---|---|---|---|---|---|---|---|
| †823 | 825 | | √ | *†823 Ley Bushed | 4.000 | 3,150 | 19,000 |
| 131 | S131 | √ | | *131 Combination | 3.075 | 3,200 | 24,000 |
| S131 | S825 | | √ | S131 Chabelco | 3.075 | 4,450 | 40,000 |
| †825 | S825 | √ | | *†825 Ley Bushed | 4.000 | 5,000 | 30,000 |
| S825 | S102½ | | √ | S825 Chabelco | 4.000 | 6,000 | 50,000 |
| †830 | S830 | √ | | *†830 Ley Bushed | 6.000 | 5,000 | 30,000 |
| S830 | S844 | | √ | S830 Chabelco | 6.000 | 6,000 | 50,000 |
| A102B | S102B | √ | | *A102B Durobar | 4.000 | 4,000 | 24,000 |
| S102B | S102½ | | √ | S102B Chabelco | 4.000 | 6,300 | 40,000 |
| 110 | S110 | √ | | *110 Combination | 6.000 | 4,000 | 24,000 |
| S110 | S844 | | √ | S110 Chabelco | 6.000 | 6,300 | 40,000 |
| A102½ | S102½ | √ | | *A102½ Durobar | 4.040 | 5,600 | 36,000 |
| S102½ | S111 | | √ | S102½ Chabelco | 4.040 | 7,800 | 50,000 |
| A111 | S111 | √ | | *A111 Durobar | 4.760 | 6,000 | 36,000 |
| S111 | S844 | | √ | S111 Chabelco | 4.760 | 8,400 | 50,000 |
| †844 | S844 | √ | | *†844 Ley Bushed | 6.000 | 6,650 | 40,000 |
| S844 | S856 | | √ | S844 Chabelco | 6.000 | 9,200 | 70,000 |
| A132 | SA150 | √ | | *A132 Durobar | 6.050 | 8,400 | 50,000 |
| | | | | SA150 Chabelco | 6.050 | 15,000 | 100,000 |
| | | | | S856 Chabelco | 6.000 | 14,000 | 100,000 |

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†Can also be furnished with alloy pins and manganese bushings.

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# *"When you reach for* **POWER,** *you've got it!"*

"Controls are easy to operate, and not spread out all over the machine. Also, Caterpillar-built Tractors don't smother down like the others. When you reach for power, you've got it!" states Troy O. Swindler, left, supervisor for Everett & Clark, contractors, of Plattsburg, Mo. He is shown here with Howard E. Huey, operator of the Caterpillar D7 Tractor with No. 7S Bulldozer, at a rock quarry near Kearney, Mo. This machine stock-piles gravel, cleans the quarry floor, and on dirt stripping moves 200 yards of dirt per hour on a 75-foot haul.

Much of this work is in "dead" or frozen materials, but the scientifically curved moldboard keeps big loads rolling fast. Tractor horsepower and blade capacity are matched for smooth and steady performance. Specially toughened steels add to the life of blade and cutting edge, and the blade is quickly detached or adjusted.

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Caterpillar Tractor Co., Peoria, Illinois.

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